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Data from three large national datasets were examined to determine the extent to which teacher–child relationships and teacher–child classwide interactions operate as unique and important interpersonal dynamics in early childhood classrooms. Confirmatory factor analysis using structural equation modeling and principle components analysis indicated in all three datasets that teacher–child relationships and teacher–child classwide interactions were best conceptualized as separate and unrelated concepts. Teacher-child relationships, but not interactions, were significantly associated with children's achievement in reading and math, and only in one dataset. Teacher–child relationships also were significantly associated with children's classroom behavior during preschool in two datasets, and these prekindergarten teacher–child relationships were significantly related to children's kindergarten problematic behavior in all three datasets. Specific to interactions, only one main effect was found, but exploratory analyses indicating possible moderating effects of classwide interaction quality on the association between teacher–child relationships and children's outcomes are discussed. Additional analyses were conducted, and are discussed, examining the potential moderation of associations between teacher–child interpersonal dynamics and children's outcomes by children's temperament.

TEACHER–CHILD INTERPERSONAL DYNAMICS: A CLOSER LOOK AT PREKINDERGARTEN CHILDREN'S CLASSROOM EXPERIENCE

by

Christine N. Maynard

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Approved by

_____
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To Mom, Dad, & Hillary for your endless and unquestioning support.
You made it possible to keep going.

To Kresha for making it safe to ask questions, safe to take risks, safe to fail.
You made it possible to think critically in a classroom.

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To the One who knows me intimately and loves me infinitely. I started down this path because I believe it to be your plan; I lay it all at your feet.
1 Peter 1:3-9

APPROVAL PAGE

This dissertation written by CHRISTINE N. MAYNARD had been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair _____

Committee Members _____

_____

_____

_____
Date of Acceptance by Committee

_____
Date of Final Oral Examination

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CHAPTER I

INTRODUCTION

Experiences in early childhood classrooms have significant influence on the social, emotional, and cognitive development of young children (Baker, Grant, & Morlock, 2008; Burchinal et al., 2008; Curby et al, 2009; Hamre & Pianta, 2001; Mashburn et al, 2008). One of the most salient people in children's experiences in the classroom is the classroom teacher. Teachers provide learning opportunities, facilitate the days' activities for children, and foster peer relationships among the children in their class. Given the central role of teachers in children's classroom experiences, interest, in recent years, has increasingly focused on teacher–child interpersonal dynamics, meaning children's daily interactions and on-going relationships with their teachers. However, clear distinctions in the conceptualization of interactions and relationships in research are lacking, as is research considering how both, together, are related to children's development in the early childhood classroom. The current study will examine three different datasets using Bronfenbrenner's bioecological theory of development, specifically the PPCT model (2006). The primary aim is to distinguish teacher–child classwide interactions and teacher–child dyadic relationships. Then, the importance of both, as well as consideration of children's temperament, is examined in association with children's learning and prosocial and problematic behavior in the classroom.

Teacher–Child Interpersonal Dynamics

The current study took a three-step approach to build upon what is currently known regarding the importance of high quality interactions and relationships between early childhood teachers and the children in their classroom. There has been a tendency in the field to research either teacher–child classwide interactions or teacher–child relationships, without fully exploring how these two interpersonal dynamics together influence children's early classroom experiences. The current study drew upon extant literature to distinguish teacher–child classwide interactions as the context in which teacher–child one-to-one relationships develop, and then use three national datasets to support this assertion. These three datasets were then used to examine the links between classwide teacher–child interactions, one-to-one relationships, and children's academic achievements and classroom prosocial and problematic behavior in prekindergarten and kindergarten. Finally, these associations were further examined in regard to a primary characteristic of the children involved—temperament.

The current study intended to advance the current state of knowledge of children's experiences in early childhood classrooms both substantively and methodologically. Substantively, the current study will build upon the current understanding of how various interpersonal processes between teachers and children in early childhood classrooms relate to children's academic and social skills. Methodologically, the current study aimed to clarify the importance of distinguishing between the average group experience of teacher–child interactions and individual teacher–child relationships. Further, the current study provides information regarding how teacher–child classwide interactions and

individual teacher–child relationships interact and the importance of incorporating both types of data when answering questions about classroom experiences for young children. Classrooms can be viewed as both a group context for children as well as an opportunity for individual teacher–child relationships. Clearer understanding of the various interpersonal dynamics occurring in early childhood classrooms has implications for professional development. Better understanding of the processes through which teacher–child dynamics impact children's learning will provide information for increasing the focus and efficiency of teacher preparation and training in order to provide children with more effective classroom experiences.

Just as children in a classroom may have different relationships with their teacher, teacher–children interactions and relationships may differentially influence young children's learning. It is likely that examination of individual characteristics of the teachers, as well, would further this understanding; however, questions regarding teacher characteristics and teacher–child interpersonal dynamics are beyond the scope of the current study. To understand how interactions and relationships impact the learning of young children, it is crucial to consider relevant characteristics of the children in question. Crockenberg's (2003) call for the inclusion of child temperament as a factor of interest in early childhood care and education research has received some attention, but has been left out of the emerging conversation regarding interactions and relationships. It is plausible that children of different temperaments benefit more or less from classwide interactions and individual relationships. Questions remain as to whether some children respond differently than others to the resources and supports available to the group at

large, and if the same types of individual relationships have the same impact for all children. If research regarding classwide interaction quality and individual relationship quality is to move forward, it must include relevant characteristics of the children involved in these relationships. In the current study, children's temperament is the child characteristic of interest.

CHAPTER II

THEORY

The bioecological theory (Bronfenbrenner & Morris, 2006) suggests that an individual's development is driven by on-going, increasingly complex exchanges over time. These exchanges, or proximal processes, are influenced by individual person characteristics and the larger context in which they occur. For many young children, one of the key contexts they experience is the early childhood classroom, and a primary proximal process within this context for children is their relationship with their teacher. Past research indicates that children's temperament is a person characteristic that influences the interactions and relationships they have with their teachers, as well as how these interactions and relationships matter for children's development (Crockenberg & Leerkes, 2005; Liew, Chen, & Hughes, 2010).

The framework for the current research study draws from Bronfenbrenner's bioecological model and Person-Process-Context-Time framework (Bronfenbrenner & Morris, 2006). Previous research has tended to view the relational process between teachers and children from either the classwide interaction perspective or from the one-to-one relationship perspective. However, teacher–child relationships and teacher–child interactions are better thought of as a process and a context, respectively. Within that teacher–child interaction context, children will experience different relationships, or proximal processes, that will distinctly influence their development over time. Thus, the

current study first examined the data for indications of support or contradiction of the following applications of the theory, and then proceeded to analyses incorporating person and time considerations.

Process & Context

Though typically clearly distinguishable in applications of the theory, process and context have become somewhat unclear in research in early care and education. Bronfenbrenner defines proximal process as "processes of progressively more complex reciprocal interactions between an active, evolving biopsychological human organism and the persons, objects and symbols in its immediate external environment" (Bronfenbrenner & Morris, 2006, p.797). Further, the microsystem context is defined as "a pattern of activities, social roles, and interpersonal relations experienced by the developing person (i.e. the children) in a given face-to-face setting with particular physical, social, and symbolic features that invite, permit, or inhibit engagement in…" proximal processes (Bronfenbrenner, 1994, p.1645). In reviewing these definitions, it appears as if classwide interactions, as they are currently measured, should be seen as an indicator of the microsystem context. What remains to be empirically tested is if these theoretical hypotheses are supported when analyses are conducted with both the teacher–child relationship proximal process and the teacher–child classwide interaction context are analyzed together.

Person. Indeed, the Person in the PPCT model has been and remains central to Bronfenbrenner's framework (Bronfenbrenner, 1994; Bronfenbrenner & Morris, 2006). Characteristics of the individual, in this case the child, come in to the model two-fold.

First, particular characteristics evoke certain processes and interactions. For example, teachers may expect young boys to be more rambunctious than young girls, and thus teachers may exercise more direct and immediate behavior guidance with boys than girls, hence young boys evoke increased monitoring and correction simply by being male. Second, how an individual experiences a given interaction is also related to innate characteristics. To continue the previous example, if two young boys in the same classroom are both evoking increased monitoring and correction from the teacher, but they differ in temperament in terms of positive and negative affect, then one may find the increased correction frustrating and become aggressive, whereas the other might respond more affably. Thus characteristics of the individual, such as temperament, not only influence the types of processes individuals will be a part of, but also how those individuals will experience and respond to processes.

Crockenberg (2003) and Phillips, Fox, and Gunnar (2011), have suggested that a critical person characteristic related to how caregiver behaviors are associated with children's outcomes is children's temperament. Temperament is characterized as "patterns of emotional reactivity" (Phillips, Fox, & Gunnar, 2011, p.45). Research has indicated differential associations between children's experiences with their teachers and their behavioral outcomes for children with different temperaments (Geoffroy, Cotes, Parent, & Seguin, 2006; Groeneveld, Vermeer, van IJzendoorn, & Linting, 2010; van Aken, Junger, Verhoeven, van Aken, & Dekovic, 2007), as Bronfenbrenner's model suggests. In other words, the same interaction involving the same words and tones of voice between a teacher and different children will be distinct because the child's distinct

characteristics and past experiences will influence how they experience that interaction. However, Bronfenbrenner noted a universal importance of ongoing interactions with significant caregivers for the development of children (Bronfenbrenner, 2001) and identified processes that were generally more and less beneficial for most children. In other words, some ongoing interactions, like responsive caregiving, will promote development more than others, like on-going criticism. Thus researchers using this theory must balance the tension between identifying expected patterns of associations among processes and recognizing the inherent variation in these processes. In an attempt to find this balance, the current study examines context and process in general, before moving on to incorporate the person characteristic of child temperament.

Time. Time is the fourth piece of Bronfenbrenner's model. Time in the PPCT model refers to several aspects of time, and in Bronfenbrenner and Morris's 2006 chapter was described in relation to three levels. It is most helpful to think of time in terms of moments (microtime), patterns (mesotime), and point in history (macrotime). Moment-to-moment proximal processes occur in microtime, and it is easy to envision in classrooms that these interactions change from one moment to the next. Mesotime can be thought of as the build up of these moments over days, months, or longer. In a classroom it is the accumulation of moment-to-moment interactions overtime that establish the patterns, expectations, and affective climate of the classroom, as well as contribute to the various relationships among individuals. Macrotime captures the idea that societal norms, expectations, and significant events will evolve over time, influence those

moment-to-moment proximal processes, and must be considered in viewing those processes.

The current study will incorporate one aspect of time—mesotime. The contexts, person characteristics, and processes of interest will all be examined for both their concurrent and prospective associations with children's academic and socio-emotional abilities. In his 1988 papers, Bronfenbrenner distinguishes behaviors and development, suggesting that any concurrent explanations relate to behaviors where as development occurs over time. In other words, explaining the child's skills in the current context and involved in the current processes only offers information related to current behaviors. By examining associations among contexts, processes, person characteristics, and later abilities, we are able to see how the first three are associated with the development of the latter.

It is important to note that the current study takes a step-by-step approach, building from current research and addressing each component of Bronfenbrenner's PPCT model. In the first research question and analyses, the distinction between process and context will be established. This distinction is for heuristic purposes and serves to call the field to acknowledge the role of both classwide teacher–child interactions and individual teacher–child relationships. The second research question and analyses will further clarify examining classwide interactions and individual relationships in regard to children's academic and socio-emotional learning. Finally, the person characteristics, in this case children's temperament, will be added to the model. Thus, the third research question and analyses will address the full PPCT model, with time accounted for as

children's academic and socio-emotional skills are examined both concurrently and in the following school year.

CHAPTER III

REVIEW OF LITERATURE

In the last two decades a plethora of findings from research examining different aspects of teacher–child interpersonal dynamics in the classroom has become available. Research of classwide interactions emphasizes a variety of behaviors, such as exchanges of affection, behavior guidance, encouragement to participate and persevere in classroom activities, and use of scaffolding, questioning, and other techniques to further children's learning (Arnett, 1989; Burchinal et al, 2008; Pianta, LaParo, & Hamre, 2008). Interactions are typically measured by trained observers in classrooms with the goal of assessing the experience of the average child in the classroom. Classrooms characterized by positive interactions occurring between teachers and children also have children with more positive emotional outcomes (Colwell & Lindsey, 2003) and more prosocial behavioral outcomes (Mashburn, et al., 2008). Quality of teacher–child interactions also has significant implications for academic outcomes (Burchinal, et al., 2008; Mashburn, et al., 2008). Extending beyond the concurrent prekindergarten years, classroom quality has been linked to academic gains through the end of the kindergarten year, regardless of kindergarten quality (Burchinal et al., 2008).

A second way teacher–child dynamics have been approached in research is assessment of the teacher–child relationship at the dyad level. One-to-one relationships are often assessed through questionnaires querying the teachers' perception of their

relationships with individual children in the classroom. Teacher reports of positive one-to-one relationships with children are consistently associated with children's higher academic achievements and language development, as well as more positive social relationships and behavior in the classroom (Gillanders, 2007; Graziano, Reavis, Keane, Calkins, 2007; Hamre & Pianta, 2001).

The extensive literature on teacher–child interpersonal dynamics from both a classwide interaction perspective and a one-on-one relationship perspective provides a convincing base for the importance of teacher–child interactions and relationships for children's learning. However, a crucial gap in the literature exists. Studies measuring and analyzing both interactions and relationships are lacking. Further, more information is needed on how child characteristics such as temperament moderates links between teacher–child interpersonal dynamics and children's outcomes. Research incorporating all three variables may provide information not currently available in the extant literature.

Relationships & Interactions

Teacher–child interactions, the moment-to-moment verbal and non-verbal exchanges between teachers and one or more children, have been measured predominantly through observer ratings. Though earlier measures, developed out of attachment theories, reflected predominantly affective qualities of the relationship (Arnett, 1989), more recent measures have emphasized aspects of teachers' facilitation of daily routines and behavior expectations, activity provision and engagement, and extension of children's learning. These types of observation rating systems aim to capture

the experience of the average child in the classroom (Jeon, Langhill, Peterson, Luze, Carta, & Atwater, 2010; Pianta et al., 2008).

Forerunners to teacher–child interaction research focused on classroom quality, and narrowed in on "process quality". Process quality can be thought of as interpersonal dynamics of the classroom that directly impact children's experiences in the classroom (NICHD, 2002). In the NICHD ECCRN study, the Observational Record of the Caregiving Environment (ORCE) was used to assess process quality, with ratings on such aspects as teachers' sensitivity and intrusiveness and classroom emotional climate and chaos. These aspects of process quality, with partial emphasis on teacher–child interactions, were related to children's academic achievement and internalizing and externalizing behaviors. From these studies, a more focused emphasis on teacher–child interactions emerged.

A wide body of research has established the importance of the quality of teacher–child interactions for children's learning and development across multiple domains. Teacher–child interactions are consistently linked to children's academic, social, and behavioral outcomes. Children in classrooms characterized by emotionally supportive teachers are more socially competent, with more positive peer social skills and fewer behavior problems (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Curby et al, 2009; Mashburn et al, 2008). Academically, children in prekindergarten classes scoring higher on the ECERS-R interaction subscale and the CLASS Instructional Support domain performed better in kindergarten on assessments of receptive language, expressive language, word recognition, and applied math skills (Burchinal et al., 2008). Curby et al.

(2009) used profile analysis to identify five quality profiles with the CLASS framework to describe early childhood classrooms and found children in classrooms with the profile highest in concept development, a dimension of instructional climate, showed the most growth in academic indicators. Mashburn (2008) compared classrooms with high, medium, and low quality social environments, as indicated by the Interaction subscale of the ECERS-R, the Interaction subscale of the Assessment Profile, and the Sensitivity subscale of the CIS, and found children in classrooms with high quality social environments performed significantly better on academic indicators at the end of prekindergarten than those children whose classrooms provided mediocre quality social environments. The current study focused on associations between the classwide interaction quality in the classroom, measured with measures focused on emotional aspects of interactions, and children's early academic performance and classroom prosocial and problematic behavior.

The other aspect of teacher–child interpersonal dynamics common in early childhood research is teacher–child relationships. Teacher–child relationships are the cumulative and ongoing interpersonal connections between a teacher and an individual child, made up of interactions, expectations, and affective quality over time (Pianta, 1999). Teacher–child relationships are typically measured through teacher report of the relationship and are often broken into indicators of either positive or negative relationships or as subscales of conflict, closeness, and dependency (Pianta, 1999). Though teacher–report studies can be threatened by mono-reporter bias, with teachers often reporting on both their relationships with children and children's outcomes, the

current study aims minimized this threat by including kindergarten teachers' assessments of children's behavior and scores from standardized direct assessments for children's learning outcomes.

At the completion of their study of more than 400 elementary students in 68 classrooms, Baker et al. (2008) concluded, "One's classroom teacher makes the largest contribution to positive school adjustment" (p.8). Using the Student Teacher Relationship Scale (STRS), Pianta and Steinberg (1992) asked teachers to report on their relationships with children in their kindergarten classrooms; they found children with teacher–child relationships that were warm and positive demonstrated more appropriate school behaviors and those children with negative relationships to have more inappropriate school behaviors. Using the same measure, Hamre and Pianta (2001) found lasting associations between kindergarten teacher–child relationships and children's later classroom behavior. Children with relationships high in conflict in kindergarten had less positive work habits in early elementary school and more discipline problems in later elementary school. Boys with more dependent kindergarten relationships also had less positive early work habit and more discipline problems in later elementary grades. Girls with closer kindergarten teacher–child relationships had more positive work habits in early elementary grades and fewer behavior problems in later elementary school than those with less close relationships; this pattern was not significant for boys. In general, positive, low-conflict teacher–child relationships benefit children (Baker et al., 2008; Liew et al., 2010).

Considered Together

As discussed above, the bioecological model suggests that developmental outcomes are related to a process in context. In this study, the process of interest is teacher–child relationships and those relationships are expected to impact children's development in the context of teacher–child classwide interaction quality. Jeon and colleagues (2010) make a persuasive argument for examining both interactions and relationships in their study that measured classwide interaction quality, individual child interaction quality, and teacher reported individual relationships. In their pivotal study, Jeon et al. measured classwide global quality using the Activities, Interaction, Program Structure, and Language-Reasoning subscales of the ECERS-R. Individual experiences of quality were measured using an adaptation of the ECERS-R targeting those items that were most pertinent to detecting quality differences in teacher–child interactions experienced by the individual children in the classroom. Trained observers used this adapted ECERS-R measure to observe each target child individually. Teacher–child relationships were measured using the STRS.

Results showed that 47% of children were identified as being in "good" quality classrooms, yet only 38% of those children were rated as having a "good" individual experience (Jeon et al., 2010). Findings from this study indicate that the level of global quality seems to limit the levels of quality individually experienced by children. However, extensive variation in individual experiences of quality existed within classrooms. In other words, although all of the children in the study who were in classrooms rated low in global quality also experienced low individual quality

interactions, some children in high quality classrooms had high quality individual experiences and some had medium quality individual experiences. In classrooms rated as medium global quality, children were identified as experiencing a range of quality (i.e., low, medium, and high) quality at the individual level. In terms of relationships, teacher–child relationships were correlated with children's experiences of individual interaction quality and children's social competence and language scores. Children's teacher–child relationships were not significantly correlated with classwide global quality ratings (Jeon et al, 2010). Though this study focused on global quality broadly, and not interaction quality specifically, it suggests that consideration of individual experiences is salient. The reality of early childhood education is that each child has one or more teacher–child relationships characterized by some degree of quality, and those relationships exist in the context of a classroom characterized by a certain level of interaction quality. However, research in the field of teacher–child interpersonal dynamics currently lacks clarity regarding the two concepts and their unique contributions to predicting children's outcomes.

Person in Context: What Children Bring To the Table

Children's temperament characteristics and how those characteristics are associated with behavior and academic outcomes have long been of research interest. Temperament characteristics have been linked to pre-reading and pre-math skills in prekindergarten age children with children rated higher for attention performing better and children rated with higher activity levels as doing worse (Coplan, Barber & Lagace-Seguin, 1999). In first grade, temperament characteristics such as activity level,

distractibility, and others have been linked to children's math and reading abilities in first grade, with characteristics such as higher activity level being related to lower scores and more persistence related to higher scores (Martin & Holbrook, 1985; Newman, Noel, Chen, & Matsopoulos, 1998). Maternal report of infant temperament has been found to quite accurately predict maternal report of children's behavior problems in prekindergarten (Oberklaid, Sanson, Pedlow, & Prior, 1993). Longitudinal research has found inhibited infants and uninhibited infants to respond to kindergarten classroom situations with behavioral differences (Rimm-Kaufman & Kagan, 2005), with kindergarteners who had been classified as uninhibited as infants being more talkative and outgoing. In terms of extreme temperament traits, prekindergarten children's negative affect has been linked to children displaying behaviors indicative of Oppositional Defiant Disorder and Attention-Deficit Hyperactivity Disorder (Maretel, Gremillion, & Roberts, 2012).

However, temperament in conjunction with teacher–child interpersonal dynamics is under-studied. In 2003 Crockenberg argued that the impact of child care on children's outcomes could not be fully understood without accounting for characteristics of the child, temperament in particular. Pleuss and Belsky (2009) found classroom quality to be associated with children's later behavior problems and conflict in later teacher–child relationships only for children with highly negative temperaments; classroom quality was not significantly related to these later outcomes for children with less negative temperaments. Crockenberg and Leerkes (2005) found negative influences of long hours in child care only for temperamentally reactive two year olds. Specifically, for children

who were in care for long hours, those who were more easily frustrated as infants had more externalizing and internalizing behaviors in toddlerhood and those who were more fearful as infants had more internalizing behaviors in toddlerhood.

In their 2011 review of literature, Phillips, Fox, and Gunnar concluded that including temperament in early care and education research will add to the understanding of which children will benefit more or less from early care experiences. Considering the above discussion regarding teacher–child interactions and teacher–child relationships, the current study examines possible moderating effect of children's temperament on associations among the quality of context and processes children experience in the classroom and those children's learning and behavioral outcomes. Given that much is known about temperament and much less is known about how temperament interacts with teacher–child interpersonal dynamics, the emphasis of analyses and discussion in the current study will be on the moderating effect of children's temperament on associations between interpersonal dynamics and children's outcomes.

Aims & Hypotheses

The overarching aim of this study is to examine associations among teacher–child interactions, teacher–child relationships, children's temperament, and children's academic and behavioral outcomes. Specifically, the first aim is to examine whether there was support for considering teacher–child classwide interactions and individual relationships as unique, but related, salient factors for research of children's early classroom experiences. The second aim is to examine how links between different aspects of teacher–child interpersonal dynamics and children's academic achievement

and prosocial and problematic classroom behaviors are moderated by children's temperament. To these ends, the current study addresses the following questions and hypotheses.

Q1. Is there support for distinguishing teacher–child classwide interactions and teacher–child individual relationships as separate interpersonal dynamics?

H1.1. A two-factor solution will provide the best model fit for teacher child interpersonal dynamics data.

H1.2. Two theoretical factors will be identified, teacher–child interactions and teacher–child relationships.

H1.3. These two theoretical factors will be moderately correlated.

Q2. How do teacher–child classwide interactions and teacher–child relationships uniquely contribute to children's academic outcomes and classroom behaviors when accounting for both dynamics?

H2.1. Prekindergarten teacher–child relationships will be uniquely associated with children's prekindergarten reading and math scores and prosocial and problem behaviors when accounting for prekindergarten teacher–child interactions.

H2.2 Prekindergarten teacher–child relationships will be uniquely associated with children's kindergarten reading and math scores and prosocial and classroom problem behavior when accounting for prekindergarten teacher–child interactions.

H2.3 Prekindergarten teacher–child classwide interaction quality will be uniquely associated with children's prekindergarten reading and math scores and prosocial and problematic classroom behavior when accounting for prekindergarten teacher–child relationships.

H2.4 Prekindergarten teacher–child classwide interaction quality will be uniquely associated with children's kindergarten reading and math scores and prosocial and problematic classroom behavior when accounting for prekindergarten teacher–child relationships.

Q3. Does teacher–child classwide interaction quality (context) moderate the association between teacher–child individual relationships (process) and children's outcomes?

H3.1 Teacher–child classwide interaction quality will moderate the association between teacher–child relationships and children's outcomes such that positive teacher–child relationships will be more beneficial in high quality classrooms.

Q4. Does children's temperament moderate the associations between either prekindergarten teacher–child relationships or prekindergarten teacher–child classwide interactions and children's outcomes?

H4.1 Children's temperament will moderate the association between prekindergarten teacher–child relationships and children's outcomes such that children characterized as having a less agreeable temperament (e.g.

less focused, more negative affect) will benefit the most from positive teacher–child relationships.

H4.2 Children's temperament moderates the association between prekindergarten teacher–child interactions and children's outcomes such that children characterized as having a more agreeable temperament (e.g. focused, positive affect) will benefit the most from teacher–child classwide interaction quality.

CHAPTER IV

METHOD

Overview of Study Design

The current study made use of three national datasets that shared several design elements and measures to address a critical gap that exists in the current literature concerning teacher–child dyadic relationships and teacher–child classwide interactions. A major strength of the methodology in this study was the use of multiple reporters and methods of data collection, which minimized the mono-reported bias often associated with teacher–child relationship studies which rely on teachers to report both their relationships with children and the children's learning or behavioral outcomes. With each data set, a separate series of analyses including a confirmatory factor analysis, analysis of a model of associations of interactions and relationships with child outcomes, and additional analysis of the aforementioned model with the addition of children's temperament was conducted. The results from the three datasets were used to support conclusions regarding the interpersonal dynamics teacher–child classwide interactions and teacher–child relationships.

All three of the datasets analyzed in the current study are nationally representative with complex sampling design. In order to maintain the representative qualities of the data and to adjust the standard errors to account for the complex sampling design, each dataset was analyzed using weights and analytic techniques to correct for inflated

standard errors but also prevent over estimating statistical significance. For the Head Start Impact Study (HSIS) and Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) replicate weights were provided and the jackknife replication method was used to adjust the standard errors. In the FACES data, Taylor Series linear estimation method was used. All statistics were completed in STATA 12 (StataCorp, 2011) using either SEM in the survey command mode (svy:sem) or MLM (xtmixed).

The sample within each dataset was narrowed to those children for whom observational classroom data were available. There is cause for concern of selection bias in this sample, as lower quality classrooms may not have consented to participation, particularly in the ECLS-B. This is an ongoing challenge in the field. To address this threat of selection bias, data collected regarding parent satisfaction with the setting was compared for observed and not observed classrooms. Weighting of the data helped to correct for attrition where individuals are missing waves of data, and most control variables were derived from multiple sources and waves, so no imputation methods were employed.

Sample

Head Start Impact Study. The Head Start Impact Study was an experimental design study aimed at understanding the impact of attending Head Start on a variety of child outcomes and is nationally representative of entering 3-year old and newly entering 4-year old children eligible for Head Start in 2002. Eighty-four grantee/delegate agencies were selected for participation based on geographic location, urbanicity, and saturation, meaning that a larger number of children in the Head Start service area qualified for Head

Start than were able to be served. From these delegations, children eligible for Head Start were randomly assigned to attend Head Start (treatment condition) or to a control condition where parents of those children were free to make any other arrangements for their children, but the children were not given an enrollment slot in Head Start. Data collection began in the fall of 2002, and continued through spring of 2006. Data was collected for a 3-year-old cohort and a 4-year-old cohort. For the purposes of this study, the two cohorts were combined and data was used from all children's prekindergarten year (year before kindergarten), as well as data collected the next year, referred to as the kindergarten year. The full sample for the HSIS study was approximately 4450 (all HSIS sample sizes rounded to nearest 25) children.

Only those children who were in center-based care during their prekindergarten year were included (n=2900). Of these, children whose classroom did not have an observation (n=550), whose teachers' did not provide a relationship rating (n= additional 125), who were missing temperament data (n=150), or who were missing data for an outcome variable (an additional 25 for reading or math, and 50 for classroom behavior) were removed from the sample. Observations were conducted in classrooms of children who attended Head Start during their prekindergarten year, as well as those children who participated in some other center-based care. The most appropriate analytic weight for this group is the weight for children who had classroom observation data, parent interview data, and assessment data at the prekindergarten time. The sample of children with classroom observations, teacher ratings of the teacher–child relationship, all outcome variables, and a weight value for the prekindergarten year was approximately

1925. An additional 200 children were removed from the current sample due to missing family income data; however, this group did not significantly differ from the retained sample on any of the outcome variables. This reduced the number of observations to approximately 1725 children for prekindergarten analyses and to approximately 1050 for kindergarten analyses. Demographic data for these children are presented in Table 1.

Table 1. Head Start Impact Study Sample Demographics

n=1725		
Gender	Male	50%
	Female	50%
Ethnicity/Race	Hispanic	35%
	non-Hispanic Black	32%
	non-Hispanic White/Other	33%
Home Language	English	72%
	Other	28
Special Need	Yes	15%
	No	85%
Mother's Education	less than High School diploma (0)	33%
	High School diploma/GED (1)	31%
	more than High School (2)	35%
Family Income (Monthly)	less than $500 monthly (0)	10%
	$501-$1000 (1)	20%
	$1001-1500 (2)	26%
	$1501-2000 (3)	18%
	$2001-2500 (4)	14%
	more than $2500 (5)	12%
All demographics presented as weighted percentages.		

Early Childhood Longitudinal Study-Birth cohort. The Early Childhood Longitudinal Study-Birth cohort is a birth cohort study representative of all children born in the U.S. in 2001. Data was collected on children beginning at 9-months of age and continuing through kindergarten, thus data was collected beginning in 2001 and the last

wave finished in the fall of 2007. A variety of measures and strategies were used to obtain information on children's health status, home environment, and early childcare and school experiences. Data were collected at four time points; data for the current study were collected when the child was 4-years-old, here after referred to as the prekindergarten year (academic year 2005-2006) and the following year, 2006-2007 academic year. The year after prekindergarten is here after referred to as the kindergarten year, though the minority of the children were in other non-kindergarten classrooms during this year. Weights for this model were most appropriate for children with classroom observations during the prekindergarten year.

The original sample for the full dataset was 10,688 children. Child care observations in center-based care were only conducted for a subset of the original sample (n= 1400). Children from this subsample who were missing the prekindergarten teacher's report of the teacher–child relationship (n<25), prekindergarten academic variables (n=50), or child temperament data (n=50) were removed from the current sample. Additional children who were missing mother's highest level of education data (n<25) were removed from the current sample. The resulting final prekindergarten sample was 1300. Demographic information for this sample is displayed in Table 2.

Table 2. Early Childhood Longitudinal Study-Birth Cohort Sample Demographics

n= 1300		
Gender	Male	51%
	Female	49%
Ethnicity/Race	Hispanic	17%
	Black	24%
	White	43%
	Other	16%
Primary Language	English	84%
	Other	16%
Child with Special Need	Yes	7%
	No	93%
Mother's Education	High School Diploma or Less	41%
	More than HS-Bachelor's	45%
	Degree	14%
	More than Bachelor's Degree	
Family Income	$500-$999	13%
(monthly)	$1000-$1499	17%
	$1500-$1999	17%
	$2000-$2499	10%
	$2500-$2999	5%
	$3000-$3499	11%
	$3500-$3999	10%
	$4000-$4499	12%
	+ $4500	4%

Head Start Family and Child Experiences Survey. The Head Start Family and Child Experiences Survey (FACES) is a longitudinal study to examine program performance in terms of the experiences families and children have in Head Start. The study began in 1997 and several rounds of data collection have been completed since. The data for the current study comes from the 2006 round, specifically the 4-year-old cohort. The 3-year-old cohort was not included because year-before-kindergarten classroom observation data was not available for this group. This cohort is nationally representative of 4-year-old children entering Head Start for the first time in the fall of

2006. Approximately 1300 children from the 4-year old cohort are included in the original dataset. Of these, approximately 300 were removed from the sample due to lack of observation data, and 1000 were retained in the current sample. Children from this cohort with observation data of their classroom, who were missing parent report of the teacher–child relationship (n=75), or academic outcome (n=50) or behavior data (n=50) were also removed from the sample in the current study, leaving approximately 800 children in the current sample. The selected analytic weight was that for children with completed classroom observation and parent interview. An additional fifty children were dropped because mother's highest level of education data was missing and the final analyzed sample size included in the current study was approximately 750 children in approximately 240 classrooms. There was an average of three study children in each classroom, though this ranged from one to 12 study children in a given classroom. Demographic information for this sample is displayed below in Table 3.

Table 3. Head Start Family and Child Experiences Survey 2006 Sample Demographics

n= 750		
Gender		
	Male (0)	52%
	Female	48%
Ethnicity/Race	Hispanic	40%
	Black	24%
	White	27%
	Other	9%
Home Language	English	66%
	Other	34%
Mother's Education	less than High School diploma	40%
	High School diploma/GED	31%
	more than High School diploma	29%
Family Income	less than $5000	4%
(annual)	$5001-10,000	8%
	$10,001-15,000	21%
	$15,001-20,000	20%
	$20,001-25,000	16%
	more than $2500	32%
Child with Special	Yes	3%
Need	No	97%

Measures

HSIS.

Independent variable: Classwide Interaction Quality. Classrooms were observed using the Caregiver Interaction Scale (CIS; Arnett, 1989) and the Early Childhood Environmental Rating Scale- Revised (ECRES-R: Harms, Clifford, & Cryer, 2004). Children's classrooms were visited for a four-hour observation during which trained observers rated the classroom using both measures. All five subscales of the CIS were included as all focus on interactions. Psychometric support for the ECERS-R original subscales is mixed. Thus, for this study, factor scores were computed for two

commonly accepted factors—Materials and Activities (α=.87), and Language and Interaction (α=.87) (Cassidy, Hestenes, Hedge, Hestenes, & Mims, 2005). These two factors were computed as the mean score of the relevant items. These two ECERS-R factors and the five CIS subscales (α=.71) were used in the confirmatory factor analysis.

Based on the confirmatory factor analysis (CFA), classwide interaction scores were also created as weighted factor scores. This strategy for creating factor scores allows for those subscales that have the largest effect to contribute the most to the total score (Burchinal & Cryer, 2003; DiStefano, Zhu, & Mindrila, 2009; Wackwitz & Horn, 1971). Using the unstandardized coefficients, classwide interaction scores were created using each Arnett subscale and the two ECERS-R factor scores. TCI= [(1*A-Det)+(2.03*D-harsh)+(1.47*A-Ind)+(.98*A-prem)+(6.54*A-sens)+(.86*ECERS-M/A)+(1.19*ECERS-L/I)].

Independent Variable: Teacher–Child Relationships. Prekindergarten teachers completed the short version of the Student Teacher Rating Scale (STRS, Pianta & Steinberg, 1992) during the spring of children's prekindergarten year. The scales is made up of two subscales—conflict and closeness—both of which have good internal consistency (α=.87, α=.80 respectively). The scale gives an overall score of how positive the relationship is when negative items were reverse coded (Baker, 2006; Jeon et al., 2010). For the purpose of this study, a single variable indicating the degree of positivity in the relationship was desired. Per the confirmatory factor analysis conducted to answer research question 1, a weighted factor score was created for teacher–child

dyadic relationships. Using the unstandardized coefficients from this CFA, the teacher–child relationship manifest variable was created as a weighted factor score. TCR= [(1*TCR-close)+(-4.18*TCR-conflict)]. By creating this weighted score each aspect of the relationship contributed to the weighted factor score, but not equally as this was not empirically implicated. Note that the standardized coefficient for the conflict scale was nearly three times as large as that of the closeness scale, and in the negative direction. The mean score on this variable was negative, with negative scores further from zero indicated more conflictual relationships; however, this caused difficulty in interpreting findings. For ease of interpretation, the teacher–child relationship variable was centered, bringing the mean to zero and the range to -126.43-32.51.

Moderating Variable: Child's Temperament. The child temperament variable was created by summing the assessor reported Leiter-R ratings regarding the child's behavior during the baseline assessment at the beginning of their first year in the project (PK year for four year old cohort, pre-PK year for 3 yr old cohort) and had high internal reliability (α=.86). Example items include assessor rating of child's task persistence ranging from child refuses the task to child "persists with task"; and child's "attention to directions" ranging from the child beginning the activity without waiting for the directions to the child paying careful attention to the directions. These items are scored such that a higher score indicated the child paid more attention, demonstrated more focus and persistence, and was generally less active and less challenging. A low score, then, is reflective of highly active children and children who were more difficult to build rapport with. This indicator of temperament was collected early in or prior to the child's

experience with the teacher who reported on both the teacher–child relationship and the child's behavior.

Dependent Variable: Academic Outcomes. Children's academic abilities were measured by direct assessment during the spring of their prekindergarten year and again during the spring of their kindergarten year. The current study uses assessment from the Woodcock-Johnson III assessments conducted in the child's primary child care setting by trained assessors. The Woodcock-Johnson III Letter-Word Identification scale score was used as a measure of reading ability and measures children's ability to identify words and letters and the Woodcock-Johnson III Applied subscale was used as an indicator of math ability. Reliability for the Letter/Word subscale is 0.98 and for the applied subscale is 0.86 with prekindergarten children (West et al., 2010).

Dependent Variable: Classroom Behavior. The children's prekindergarten teachers rated their behavior and performance in the classroom using the Adjustment Scales for Prekindergarten Intervention (ASPI; Lutz, Fantuzzo, and McDermott, 2000). The ASPI consists of 24 items that describe classroom situations; teachers select a description that best fits the child's behavior for each situation from both typical and problem behavior descriptions. For example, teachers might select the description, "Overly rough with other children in games" or "Needs encouragement to join in games." These descriptors would contribute to the aggressive and shy dimensions, respectively. For the current study, the five subscales (Aggressive, Oppositional, Inattentive/Hyperactive, Shy, and Withdraw/Low Energy, as included in the HSIS dataset) were collapsed into two overarching subscales—undercontrol and overcontrol

(Bulotsky-Shearer & Fantuzzo, 2004; Fantuzzo et al., 2007), referred to as withdrawn behavior problems and disruptive behavior problems respectively from here forward. Withdrawn behavior problems included the withdrawn dimension and shy dimension, and the disruptive behavior problems subscale consisted of the aggressive, inattentive/hyper, oppositional dimensions. Alphas in the current study for the two subscales, over control and under control in this sample were .72 and .73, respectively, at the prekindergarten time point, and .70 and .74 at the kindergarten time point.

Control Variables. Child gender was based on parental report and scored such 0=male and 1=female. Child's ethnicity and race is also based on parental report, and drawn from recruitment information when parental report is missing. Statistically, Hispanic children serve as the comparison group; and dichotic variables were created to indicate children who are non-Hispanic Black and non-Hispanic White or other race. In other words, significant findings in regard to ethnicity and race indicate significant differences in relation to Hispanic children. Children's home language is based on parental report during the fall of the prekindergarten year of the language predominantly spoken to the child at home and scored such that 0=English and 1=other. Mothers reported on their highest level of education as of the Spring of 2003, and in the current study this variable is divided into mothers' with less than a high school diploma, mothers' with a high school diploma or GED, and mothers' with education beyond a high school diploma, ranging from some college to advanced degrees. Family income was reported by the mother as the total income coming into the household per month, and is provided in the dataset as a categorical variable divided by $500 increments. Whether or

not a child had a diagnosed special need was determined by mothers' report of if the child's physician had stated the child had a special need and was scored as 0= no identified special need, 1= identified special need.

ECLS-B.

Independent variable: Classwide Interaction Quality. Much like the HSIS, classwide interactions in the ECLS-B were measured using the Caregiver Interaction Scale (CIS; Arnett, 1989) and the Language & Talking, Learning activities, and Interaction subscales from the Early Childhood Environmental Rating Scale-Revised (ECERS-R, Harms, Clifford, & Cryer, 2004). A weighted interactions factor score was created based on the confirmatory factor analysis with the sample in the current study. [TCI= [(1*A-Det)+(2.37*D-harsh)+(.97*A-prem)+(4.66*A-sens)+(1.00*ECERS-LT)+(.68*ECERS-LA)+(1.07*ECERS-INT)].

Independent Variable: Teacher–Child Relationships. Prekindergarten teachers completed six items from the Student Teacher Rating Scale (Pianta & Steinberg, 1992), to describe their relationship with each individual child. Items, rated on a three-point scale from "never" to "often", included both indicators of closeness ("if upset, [child] will seek comfort from me") and conflict ("[child] and I always seem to be struggling with each other"). The reliability for these six items when given equal weight was unacceptable; computing a closeness subscale (α=.40) and a conflict subscale (α=.70) resulted in low reliability on the closeness subscale. However, by weighting each question to create the factor score, conflict items contributed to the child's relationship quality score with two to three times the weight of closeness items. Using the

unstandardized coefficients from this CFA, the teacher–child relationship manifest variable was created as a weighted factor score. Weighting the conflict items greater than the closeness items resulted in the majority of children having negative scores, making interpretation somewhat difficult. As such, the teacher–child relationship variable was centered; the resulting mean is zero and scores with negative values indicate relationships that are less positive than the average teacher–child relationship in this sample.

Moderating Variable: Child's Temperament. Children's temperament in the ECLS-B was assessed during the 9-month data collection and the 2-year old data collection. The current study uses temperament data from the 2-year old data collection. Trained assessors reported about children's general demeanor during assessment using the Bayley Short Form-Research Edition (BSF-R) with children. This measure was created for the ECLS-B from the Bayley Scales of Infant Development, Second Edition (BSID-II; Bayley, 1993). A score was created from five items reported by the trained assessor in regard to the child's engagement, affect, and sociability during the assessment (5 items; α =.81). Higher scores indicate that children were rated as being generally more sociable and having more positive affect during the assessment.

Dependent Variable: Academic Outcomes: Academic outcomes were assessed using a battery designed for the ECLS-K study. Items were taken from established standardized tests as well as items created for the study. The literacy assessment contained 35 items and covered five literacy constructs (phonological awareness, letter sound knowledge, letter recognition, print conventions, and word recognition). The math assessment consisted of 45-items across six constructs (number sense, counting,

operations, geometry, pattern understanding, and measurement). Item Response Theory (IRT) scores for both literacy and math were created, which are interpreted as the number of items from the total pool of items (85 for reading and 71 for math) that the child would be expected to answer correctly. Internal reliability of the IRT scores is relatively high, with alpha coefficients of .84 and .89 for the age 4 reading and math assessments respectively, and .93 and .92 for the same assessments at age 5 (Najarian, Snow, Lennon, Kinsey, & Mulligan, 2010, 2010)

Dependent Variable: Classroom Behavior. Teachers reported on children's classroom behavior using 16 items taken from the Preschool and Kindergarten Behavior Scales-2nd Edition (PKBS-2; Merrell, 2003). Teachers rated each statement on a 1 (never) to 5 (very often) scale indicating how frequently the statement described the target child. Items were added from the ECLS-K instrument to be sure that the areas of approaches to learning and friendship were also covered by the social/emotional measure.

The User's Manual for the ECLS-B prekindergarten year (Snow et al., 2007) suggests that researchers conduct factor analysis to determine how to combine items from the measure. Factor analysis from the current study confirmed two subscales- positive classroom behavior and problematic classroom behavior. The positive subscale is comprised of items such as "child makes friends easily" and "child pays attention". The problematic behavior subscale is comprised of items such as "child disrupts others" and "child annoys other children". In the current study sample, the reliability for the positive classroom behavior (10 items; α=.98 at age 4; α=.97 at age 5) and problematic classroom behavior (9 items; α=.98 at age 4; α=.96 at age 5).

Control Variables. Similar control variables were selected from the ECLS-B dataset as the HSIS. Child gender was based on parental report and coded such 0=male and 1=female. Child's ethnicity and race is also based on parental report, and drawn from recruitment information when parental report was missing. Hispanic children served as the comparison group; and dichotic variables were created to indicate children who are non-Hispanic Black, non-Hispanic White, or another race. Children's home language was based on parental report during the 9-month data collection of the primary language predominantly spoken in the home and scored such that 0=English and 1=other. Mothers reported on their highest year of education completed as of the 2-year old data collection (2003-2004), and this variable was divided into mothers' with a high school diploma or less education, mothers' with more than high school diploma and/or a 4-year college degree, and mother's with more than a 4-year college degree. Family income was reported by the mother as the total income coming into the household annually and provided in the dataset as a categorical variable divided by $500 increments. Mothers reported if the child's physician had stated the child had a special need. Special need status was coded as 0= no identified special need, 1= identified special need.

FACES 2006.

Independent variable: Classwide Interaction Quality. Trained observers conducted classroom observations; they had received 4 days of training and two days of practice in prekindergarten classrooms using these measures. Observers rated classrooms using the ECERS-R (Harms, Clifford, & Cryer, 2004), the Caregiver Interaction Scale (CIS; Arnett, 1989), and the Classroom Assessment Scoring System (CLASS; Pianta et

al., 2008). Detailed descriptions of the CIS and ECERS-R are provided above. The CLASS is an observation-based measure consisting of ten dimensions within three domains. Observers observe in 20 minutes cycles and rate the classroom on a scale of 1-7 on each dimension. These CLASS scores reflect the average score across each dimension. In the FACES 2006 dataset only the Concept Development, Quality of Feedback, and Language Modeling dimensions were used. These dimensions make up the Instructional Support domain, and publisher reported reliability for the CLASS Instructional Support domain is 0.79 (West et al., 2010). Inter-rater reliability was 87% for the FACES 2006. In this particular dataset the ECERS-R subscale scores are provided, as well as a "teaching" subscale made up of items from various other subscales representing those focused on teaching and interacting.

A CFA was conducted specifying the five CIS subscales, the CLASS instructional support subscale, and the ECERS-R teaching and interaction subscale. The classwide interaction score was created as a weighted factor score based on the varimax rotated weights from the CFA on this dataset. Nothing appeared remarkably different from the HSIS dataset, though the two were not compared statistically. They contain some different indicator variables so there is some change. TCI= [(A-Det*0.57)+(A-harsh*0.72)+(A-Indp*-0.33)+(A-Prem*.74)+(A Sens*0.83)+(ClassIS*.63)+(ECERS-R_teach*.79)].

Independent Variable: Teacher–Child Relationships. No teacher-reports of teacher–child relationships were collected in the FACES 2006 survey. However, maternal report of the children's relationships with their teachers was collected through a

series of five questions regarding the child's experience with the teacher (e.g. "The teacher was warm and affectionate towards [child]"; "[child] feels accepted by the teacher"; Mathematica, 2010). Mother's rated how often this occurred on a four point scale ranging from "never" to "always". This variable was provided as a scale score in the dataset based on parental report of satisfaction with the Head Start experience particularly as related to the child's experiences, and scale reliability information was unavailable.

Moderating Variable: Child's Temperament: Child's temperament was assessed and scored for the FACES study in the same way as the HSIS. The child temperament variable was created by summing the assessor reported Leiter-R ratings regarding the child's behavior during the baseline assessment in the fall of the prekindergarten year. A summary score was created by averaging the four subscales (attention, organization/impulse control, activity level, and sociability). The reliability of these subscales ranges from 0.92-0.97 (West et al., 2010). Items are scored such that a higher score indicates the child pays more attention, demonstrates more focus and persistence, and is generally less active and less challenging and a lower score, then, is reflective of highly active children and children who are more difficult to build rapport with.

Dependent Variable: Academic Outcomes*:* Children's academic abilities were assessed using the same WJIII subscales as in the HSIS dataset—Letter/Word and Applied. Here, too, standardized scores are used. Standardized scores allow for meaningful of interpretation of effect sizes in that we can determine how given variables are related to change in children's score relative to children's same age peers. According

to the FACES User Guide (West et al., 20010) reliability for the applied subscale is 0.86 and for the letter/word is 0.98 with prekindergarten children.

Dependent Variable: Classroom Behavior. Children's cooperative classroom behavior was assessed using items from the Social Skills Rating System (Elliott, Gresham, Freeman, & McCloskey, 1998; Gresham & Elliott, 1990 as cited in West et al., 2010) and the Personal Maturity Scale (Zill & Daly, 1993 as cited in West et al., 2010). The reliability for the SSRS is 0.94 and the PMS subscales range from 0.74-0.85 (West et al., 2010). Teachers rated how often children demonstrated helpful and cooperative behaviors, such as "follows the teacher's directions" on a scale of 1-3 with low scores indicated the child never demonstrates such behaviors and 3 indicating the child demonstrates the behavior "very often". Higher scores indicate that children more frequently demonstrate positive behaviors. Children's problematic classroom behaviors were also rated by classroom teachers, using items from the Personal Maturity Scale and the Behavior Problems Index (Peterson & Zill, 1986 as cited in West et al., 2010, α=0.88-0.89). Teachers responded to statements rating them as "never" (1) to "always" (3) in regard to the child. Item's included "hit/fights with others". Higher scores indicate more problematic behavior.

Control Variables. Control variables used in these models are as similar to those in the HSIS data as possible. Child gender was determined by parent report and is coded as 0=male and 1=female. Child race/ethnicity was also determined from parent report using the following categories: Hispanic, White, African American, or other (including American Indian/Alaska Native, Asian/Pacific Islander, bi/multiracial, and those who

self-reported as "other race"). Hispanic children serve as the comparison group for all analyses and dichotic yes/no variables were created for the other groups. Children's home language was reported by parents and is coded English=0 and other language=1. Mothers reported on their highest level of education, and this was categorized in the current study as those who have less than a high school diploma, those mothers with a high school diploma or GED, and those with more than a high school diploma. Mothers also reported total annual household income, which was provided categorized into groups by $5000 increments. Parents reported whether or not a doctor or health care professional had ever mentioned the child having a disability or other special need, including and not limited to physical disabilities, learning disabilities, and/or emotional or behavioral special needs.

Moderation Variables. For each dataset, several possible statistical interactions were hypothesized, thus three interaction term variables were created—teacher–child relationships by interactions, teacher–child relationships by temperament, and teacher–child interactions by temperament. In each case, the two continuous variables were multiplied. Given that the term "interaction" has specific and salient meaning in the current study, "product term" will be used from here forward to describe statistical interaction terms.

Analyses

Where possible, the same analytic techniques were used across datasets. Even when this was not possible, such as FACES models related to children's outcomes, as many similarities were maintained as possible. The remaining method section (and results

section) are organized and discussed by research question. In all structural equation models, the standardized root mean square residual (SMRM) will serve as the fit index, as many of the more common chi-square-based fit indices are not appropriate for weighted data (Kline, 2011; StataCorp, 2011). For this index, scores closer to zero are better and the accepted guideline is that scores of .08 or less indicate good fit (Hu & Bentler, 1999). The coefficient of determination is also provided, which indicates the proportion of variance explained.

RQ 1: Is there support for distinguishing teacher–child classwide interactions and teacher–child dyadic relationships as separate interpersonal dynamics? To answer the first research question, and to inform all further analyses using the HSIS data, confirmatory factor analysis was conducted using structural equation modeling. A priori, a two-factor model was hypothesized, and this model was compared to a single factor model and a three-factor model. The hypothesized model specified two latent factors—Relationships and Interactions—with TCR-closeness and TCR-conflict, as indicated by teacher report on the STRS loading on Relationships. The five Caregiver Interaction Scales subscales and two ECERS-R factor scores were all loaded on the latent Interaction variable. The second model specified all teacher–child interpersonal dynamics indicators loaded onto one latent TCID factor. Finally, a third solution was specified with all items loading onto latent factors representative of their individual measure. Both TCR closeness and conflict were loaded on an STRS latent variable, all five Caregiver Interaction Scale subscales were loaded onto a CIS latent

variable, and both ECERS-R factor scores were loaded onto an ECERS-R latent variable. For each of these, fit statistics were examined.

Using the ECLS-B, analyses similar to those with the HSIS data were conducted. Three models were analyzed, with the major difference between the ECLS-B and the HSIS data being that three of the original ECERS-R subscales were used instead of the two ECERS-R factors in the HSIS. This is due to raw items not being available for the ECLS-B data; and further, Kline (2011) suggests that, in structural equation modeling, the use of subscales as indicators is preferable to individual items as it results in data that more closely resembles continuous data.

Due the single indicator of teacher–child relationship, the FACES data has to be handled slightly differently. Though SEM CFA could not be fitted, the a priori hypothesis was that a two-factor solution—Relationships and Interactions—would be appropriate for this data as well. Principal components analysis was reviewed to determine the number of components with Eigen values greater than 1.00 and visually inspected (Brown, 2006). Principal axis factoring with varimax rotation was reviewed to determine factor loadings.

RQ 2: How do teacher–child classwide interactions and teacher–child dyadic relationships uniquely contribute to children's academic outcomes and classroom behaviors when accounting for both dynamics? To address the question of unique associations among either TCR and children's outcomes or TCI and children's outcomes when the other is accounted for structural equation path models were specified. As noted above, all variables were created as manifest variables to allow for the use of path

modeling to examine moderation (Kline, 2011). Moderation analyses with latent variables can be challenging to interpret and would not serve the primary purpose of the current study in helping to clarify measurement related to teacher–child classwide interactions and dyadic relationships. Separate models were specified for academic and behavior outcomes. The specified models included both teacher–child relationships and teacher–child interactions as predictors of each DV, as well as the control variables of child sex, race, age at time of assessment, home language, diagnosis of special needs status, base temperament, mother's highest level of education, family income, and the teacher–child ratio of the prekindergarten classroom when observed. All models were run using the appropriate prekindergarten year weight and jackknife replicates. As mentioned above, the SRMR was examined in regard to model fit.

Given the nested nature of the FACES data (as the only dataset in the current study with multiple study children in the same classroom), multilevel regression models were fit to analyze the data. This analytic strategy not only allows us to examine the proportion of variance occurring with classrooms and the proportion occurring between, but also accounts for any systematic measurement error that is related to the classroom children are in (Raudenbush & Bryk, 2002). In each model, the child's classroom is entered as the level 2-grouping variable. To answer research question 2 regarding unique associations between teacher–child relationships and children's outcomes and teacher–child interactions and children's outcomes when both are accounted for, a series of multilevel models were fit. A series of hierarchical models were analyzed. Only full

models including all child and classroom variables are presented here; hierarchical models are presented in the appendix.

RQ3. Do teacher–child classwide interactions moderate the association between teacher–child dyadic relationships and children's outcomes? According to Bronfenbrenner's PPCT model, each element of the model has the potential to interact with the others. As Bronfenbrenner once wrote, "In ecological research, the principal main effects are likely to be interactions" (Bronfenbrenner, 1977, p.518). In other words, our primary interests lies not in the associations between the outcome variables and any one aspect of the model, but rather in how the context, process, and person characteristics together influence development over time. To this end, analyses were conducted to determine if there were any moderating effects of teacher–child classwide interactions on the association between relationships and children's academic abilities and classroom behaviors. To determine if the influence of teacher–child relationship quality on children's outcomes is moderated by teacher–child interactions, a product term variable was created using the product of the teacher–child relationship and teacher–child interaction variables. Then this variable was added to the models specified above and analyzed.

RQ4. Does children's temperament moderate the associations between either prekindergarten teacher–child relationships or prekindergarten teacher–child classwide interactions and children's outcomes? To determine if children's temperament moderated the associations between teacher–child interpersonal dynamics and children's outcomes two additional product terms were created—a teacher–child

relation x temperament variable and a teacher–child interaction x temperament variable. The original models were reanalyzed with the addition of just the teacher–child relationship by temperament variable or just the teacher–child interaction by temperament variable. Significant product terms were interpreted by dividing the sample into three groups by temperament score using STATA's quantile function. Then the associations between TCR or TCI and the child outcome for each of these groups were visually inspected and are displayed in graphs below.

CHAPTER V

RESULTS

The primary goal of the current study was to examine whether teacher–child interactions and teacher–child relationships should be considered separate aspects of teacher–child interpersonal dynamics in the early childhood classroom, and then to examine the unique and combined associations of each with children's academic and classroom behavior outcomes. In recognition of children's individual characteristics, these associations were examined in terms of how they interacted with children's temperament. In order to achieve these aims, data from three studies were examined. First, confirmatory factor analysis was used to examine the factor structure of teacher–child interpersonal dynamics in each study. Then, once a structure was determined, associations among children's teacher–child relationships, teacher–child interactions, and academic and classroom behavior outcomes were examined using structural equation modeling in the HSIS and ECLS-B datasets, and multilevel modeling in the FACES dataset. Moderation analyses were conducted using product terms to ascertain if teacher–child interactions and teacher–child relationships combined to influence children's outcomes. Finally, because children's temperament has previously been identified as a moderator of associations between aspects of teacher–child interpersonal dynamics and children's behavioral outcomes (Geoffroy et al., 2006; Groeneveld et al., 2010; van Aken, Junger, Verhoeven, van Aken, & Dekovic, 2007), product terms were used to

analyze the moderating effect of children's temperament on the associations between teacher–child interactions, teacher–child relationships, and children's outcomes.

Preliminary Analyses

Sample characteristics for each dataset are provided in the Methods section. Weighted means, standard errors, and ranges for the key analysis variables in each dataset are provided below in Tables 4, 5 & 6. Note that in both the HSIS and ECLS-B, the teacher–child relationship variable has been centered, so a score of zero on this variable would indicate a relationship scored at the average level of positivity in that sample.

Table 4. HSIS Means, Standard Errors, and Ranges for Weighted Continuous Variables

n=1725	Mean	SE	Range
Teacher–Child Relationship	-.29	1.68	-126.43-32.51
Teacher–Child Classwide Interactions	241.75	1.29	45.31-304.22
PK Reading	97.27	1.24	59-139
PK Math	90.22	1.22	26-123
PK Withdrawn Behavior Problems	47.80	.32	40-73
PK Disruptive Behavior Problems	50.10	.44	42-72
K Reading	104.43	1.00	56-145
K Math	96.32	1.05	25-146
K Withdrawn Behavior Problems	48.24	.31	40-71.5
K Disruptive Behavior Problems	49.38	.34	42-71
Child's Temperament	25.70	.40	9-72

Table 5. ECLS-B Means, Standard Deviations, and Ranges for Weighted Continuous Variables

n= 1300	Mean	SD	Range
Teacher–Child Relationship	.10	3.56	-18.01-3.53
Teacher–Child Classwide Interactions	191.82	40.63	12.30-243.70
PK Reading	27.09	10.62	11.82-80.27
PK Math	30.79	9.61	9.86-65.74
PK Prosocial Classroom Behavior	3.79	.58	1.2-5
PK Problematic Classroom Behavior	2.08	.77	1-5
K Reading	42.48	.14.38	12.86-82.48
K Math	42.40	9.44	11.23-69.69
K Prosocial Classroom Behavior	3.96	.67	1.33-5
K Problematic Classroom Behavior	1.94	.72	1-4.78
Child's Temperament	3.63	.81	1-5

Table 6. FACES 2006 Means, Standard Deviations, and Ranges for Weighted Continuous Variables

n=800	Mean	SD	Range
Teacher–Child Relationship	3.81	.43	1-4
Teacher–Child Classwide Interactions	45.71	8.14	18.57-60.21
PK Reading	97.38	14.02	38-132
PK Math	88.92	13.61	63-142
PK Prosocial Classroom Behavior	17.89	4.49	2-24
PK Problematic Classroom Behavior	6.98	6.52	0-29
K Reading	107.78	12.76	60-154
K Math	95.11	14.47	39-137
K Prosocial Classroom Behavior	17.89	4.49	2-24
K Problematic Classroom Behavior	6.98	6.52	0-29
Child's Temperament	62.17	16.39	4-81

Weighted correlation tables (see Tables 7, 8, and 9) of the primary variables of interest are also provided below. Pairwise correlations indicate no statistically significant association between teacher–child relationships and teacher–child interactions in any of the three datasets, yet each is associated with child outcomes. These preliminary indications suggest that the answer to research question one is less intuitive

than anticipated. There is strong support for the notion that both teacher–child relationships and classwide interactions are separate and important aspects of teacher–child interpersonal dynamics, but no support for the idea that they are related to one another.

Table 7. Head Start Impact Study Pairwise Correlations

	1	2	3	4	5	6	7	8	9	10
1.TCR	1.00									
2.TCI	0.04	1.00								
3.PK Reading	0.12*	0.03	1.00							
4.PK Math	0.05*	0.10*	0.46*	1.00						
5.PK	-0.17*	0.06*	-0.08*	-0.12*	1.00					
6.PK	-0.62*	0.05*	-0.12*	-0.08*	0.08*	1.00				
7.K Reading	0.04	0.04	.54*	0.36*	-0.06*	-0.03	1.00			
8. K Math	0.08*	0.06*	.40*	0.52*	-0.06*	-0.12*	0.46*	1.00		
9.K Withdrawn	-0.05	0.07*	-0.18*	-0.17*	0.29*	-0.5	-0.18*	-0.20*	1.00	
10. K	0.42*	-0.02	-0.10*	-0.07*	-0.04	0.49*	-0.07*	-0.08*	0.09*	1.00

*=p<.05

Table 8. Early Childhood Longitudinal Study-Birth cohort Pairwise Correlations

	1	2	3	4	5	6	7	8	9	10
1.TCR	1.00									
2.TCI	-0.02	1.00								
3.PK Reading	0.13*	0.03	1.00							
4.PK Math	0.09*	0.05	0.76*	1.00						
5.PK Prosocial	0.49*	0.00	0.30*	0.29*	1.00					
6.PK Problem	-0.67*	0.00	-0.18*	-0.21*	-0.58*	1.00				
7.K Reading	0.06	0.04	0.66*	0.63*	0.30*	-0.16*	1.00			
8. K Math	0.02	0.08*	0.63*	0.70*	0.27*	-0.14*	0.80*	1.00		
9.K Prosocial	0.26*	0.00	0.26*	0.28*	0.39*	-0.35*	0.30*	0.27*	1.00	
10. K Problem	-0.38*	-0.12*	-0.21*	-0.20*	-0.34*	0.50*	-0.28*	-0.21*	-0.61*	1.00

*=p<.05

Table 9. Head Start FACES 2006 Pairwise Correlations

	1	2	3	4	5	6	7	8	9	10
1.TCR	1.00									
2.TCI	0.06	1.00								
3.PK Reading	-0.03	0.08*	1.00							
4.PK Math	0.01	0.00	0.44*	1.00						
5.PK Prosocial	0.02	0.12*	0.17*	0.19*	1.00					
6.PK Problem	-0.03	-0.08*	-0.20*	-0.19*	-0.67*	1.00				
7.K Reading	-0.01	-0.02	0.53*	0.40*	0.16*	-0.18*	1.00			
8. K Math	0.04	0.02	0.37*	0.55*	0.20*	-0.17*	0.53*	1.00		
9.K Prosocial	0.06	-0.01	0.16*	0.13*	0.30*	-0.36*	0.22*	0.20*	1.00	
10. K Problem	-0.07	0.07	-0.21*	-0.15*	-0.30*	0.44*	-0.29*	-0.22*	-0.78*	1.00

*=p<.05

To further visually inspect the association between teacher–child relationships and teacher–child classwide interactions, each dataset was divided into groups. If teacher–child relationships and classwide interactions were considerably associated with each other, the children in a given sample experiencing the lowest interaction quality would be expected to also be the children experiencing the least positive relationships. Within a dataset, children were assigned to one of three quantiles based on their teacher–child relationship score (least positive, average, and most positive), as well as one of three quantiles based on their teacher–child classwide interaction score (lowest quality, average quality, and highest quality).

Note that well-fitting quantiles could not be established in the FACES data due to restricted variation, and so the quantiles displayed here were determined through visual analysis. Table 10 below displays the percentage of children with each combination of relationship positivity and classwide quality in a given dataset. In other words, about 30% of children should fall in each of the boxes along the diagonal, so that most of the

children in the highest interaction quality classrooms were the same children experiencing the most positive relationships. However, there is great variation in how positive the relationships that children are experiencing are in each of the quality groups.

Table 10. Quantiles of Teacher–Child Relationship Positivity and Classwide Interaction Quality

	HSIS			ECLS-B			FACES		
	Least Positive	Average	Most Positive	Least Positive	Average	Most Positive	Least Positive	Average	Most Positive
Lowest Quality	12%	11%	10%	10%	13%	12%	4%	6%	23%
Average Quality	12%	10%	11%	12%	14%	15%	3%	7%	23%
Highest Quality	10%	12%	12%	6%	6%	12%	3.5%	5.5%	24%

In each of the three datasets, the teacher–child relationship variable is skewed, particularly in the FACES data where the data is parent reported. Square-root transformation was attempted in the HSIS dataset; however, it made little change in straightening out the linear relationship between the TCR variable and children's outcome variables, and little to no difference in the hypothesis-testing models when the square-root variable was used. Thus, the original skewed variable was retained in all three datasets. This effects interpretation and stability of results; use of analysis techniques employing robust standard errors is suggested (Raykov & Marcoulides, 2006).

Given that all analyses were conducted using replication techniques that aim to counter similar problems regarding standard errors in weighted data and that provide robust standard errors, the threat is minimized to the extent possible.

Selection bias for centers of varying quality agreeing to participate or not participate in observations was a concern. To reduce this concern, parent responses to questions regarding their children's child care experiences were compared for children in center care with observations and children in centers where observations were not completed. In the HSIS, parents were asked to rate the extent to which they felt their children were safe and their children received enough individual attention in their care setting. In the HSIS parents responses regarding the amount of individual attention their children received and the child feeling safe in the classroom did not significantly differ for children with and without observations. Parents in the ECLS-B were not asked about their satisfaction with their children's care setting, but were asked if they had good choices for child care. There was no significant difference on this variable between children in center care whose centers had been observed and those who had not. In the FACES 2006 data, parents were asked several questions about their satisfaction with their experience and their child's experience with Head Start. Note that the child's experience variable is the same variable used to describe the teacher–child relationship in analyses using this data. No statistically significant differences on either parents' satisfaction with their experience or parents' rating of children's experience were identified between those children with observations and those without.

RQ1: Is there support for distinguishing teacher–child classwide interactions and teacher–child dyadic relationships as separate interpersonal dynamics?

Head Start Impact Study. To address the first research question, a confirmatory factor analysis was conducted. The a priori hypothesized model was a two-factor model with the two subscales of the Student–Teacher Relationship Scale (Pianta & Steinberg, 1992) loading onto a single Relationship factor and the 5 Caregiver Interaction Scale subscales (Arnett, 1989) and two ECERS-R factor-derived subscales loading onto an Interaction factor. Correlation between the Relationship and Interaction latent variables was hypothesized. Structural equation modeling is best used when the hypothesized model is compared to plausible alternative models (Kline, 2011), so two additional models were tested. First, a single Teacher–Child Interpersonal Dynamics factor model was fit with all 9 subscales loading onto a single factor. Second, a three-factor model was fit, with the STRS subscales loading on a Relationship factor, the CIS subscales loading on a CIS factor, and the ECERS-R subscales loading on an ECERS-R factor. A correlation between the Relationship factor and CIS factor was hypothesized, as was a correlation for the CIS factor and the ECERS-R factor.

Given the nature of weighted data with complex survey design, only fit indices based on residuals are appropriate, thus the standardized root mean square residual (SRMR) is used (Kline, 2011; StataCorp, 2011). Good fit was indicated for the two-factor model with an SRMS of 0.032; an SRMR of greater than 0.08 is considered poor fit and values closer to zero indicate better fit (Kline, 2011). The coefficient of determination, an indication of the percent of variance explained, was 0.999. All of the

indicators load significantly on their hypothesized factors (see Table 8/Figure 1). However, the correlation between the Relationship and Interaction factor was .058 and only approached significance (p=0.098). It should be noted that the error variance for TCR-conflict was constrained to 0.25; this variable originally had a negative variance (-0.93) and the model would not converge (Gorsuch, 1983; Kline, 2011).

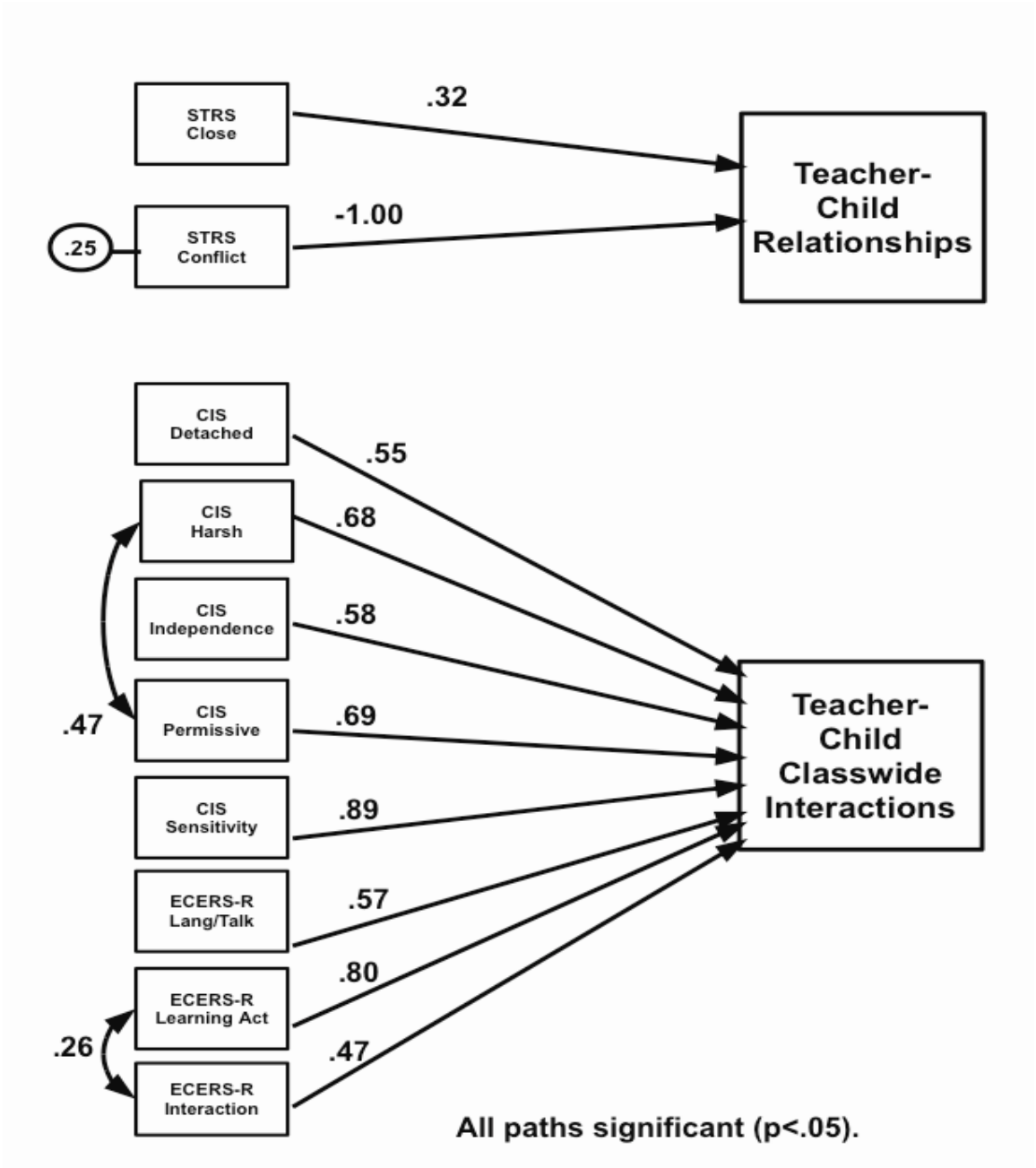
Poor fit was indicated for the one factor model (SMRS=0.280, CD=0.994). Further, several of the subscales did not load significantly on the factor (CIS Detached, Harsh, Independent, Permissive, ECERSR Materials and Activities, ECERSR Language and Interaction). This one-factor model has poor fit and was rejected.

The three-factor model had good fit, with an SMRS of 0.032 and a CD of 1.00. All indicators loaded significantly on their anticipated factor. However, given that both the two-factor and three-factor models achieve good fit, the principle of parsimony would advocate for use of the two-factor model. Further support for the two-factor model is found in that the CIS factor and ECERS-R factor were significantly correlated, but the CIS factor and Relationship factor were not. Based on all of these findings, a two-factor model was determined to be the best model to move forward with.

Table 11. HSIS CFA Two-factor Solution

SMRS=.03 CD=.99	Unstandardized Coefficient (SE)	Standardized Coefficient
STRS Close -> Relationship	1***	.32
STRS Conflict -> Relationship	-5.16 (.67)***	-1.00
CIS Detached -> Interaction	1***	.55
CIS Harsh -> Interaction	2.07 (.27)***	.68
CIS Independence -> Interaction	1.47 (.21)***	.58
CIS Permissive -> Interaction	.98 (.15)***	.69
CIS Sensitivity -> Interaction	6.48 (.77)***	.89
ECERS-R Materials & Activities -> Interaction	.84 (.12)***	.57
ECERS-R Language & Interaction -> Interaction	1.18 (.14)***	.80
CIS Harsh*CIS Permissive	.71 (.17)***	.47
ECERS-R M/A*ECERS-R L/I	.19 (.05)***	.26
Relationship*Interaction	.06 (.17)	.05

Figure 1. Head Start Impact Study Confirmatory Factor Analysis Two-factor Solution



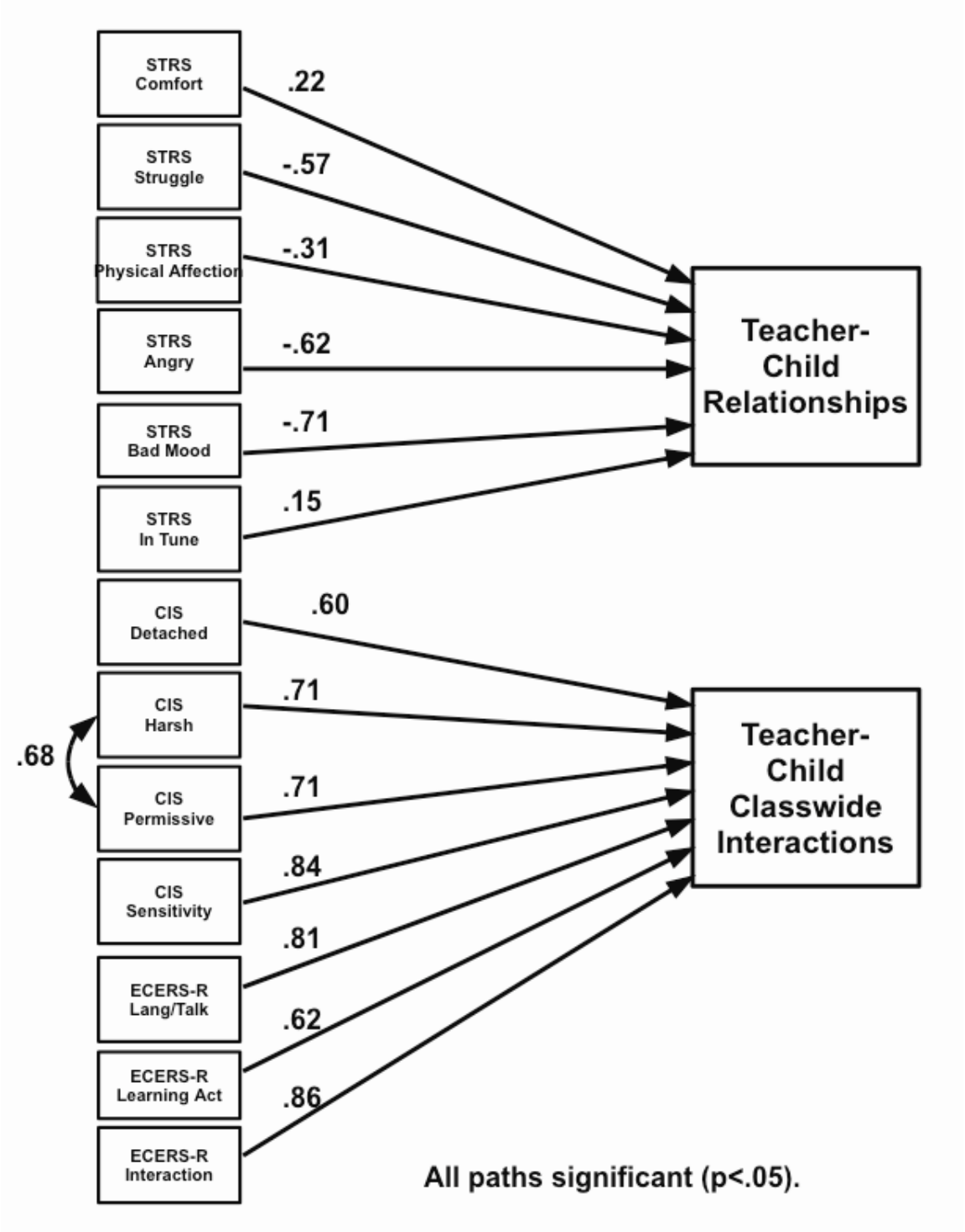
Early Childhood Longitudinal Study-Birth cohort. A two-factor model was specified using the three ECERS-R subscale scores Language and Talking, Learning Activities, and Interaction. Many of the items used to make up the two factor scores identified in the Cassidy et al. (2005) article fall in the remaining subscales. The two-factor model achieved good fit (SMRS=.05) and all items loaded significantly on their hypothesized latent variable (see Table 10, Figure 2). As with the HSIS data, this two-factor model was compared to a one-factor and three-factor model. The one-factor solution would not converge. Non-convergence of structural equation models can be due to colinearity of variables, empirical under-identification, and improper model specification (Kline, 2011). Again the three-factor model achieved good fit, but did not add useful information. The revised two-factor model, shown below, was accepted and used to calculate weighted factor scores.

Table 12. ECLS-B CFA Two-factor Solution

SMRS= 0.05 CD= .97	Standardized Coefficient (SE)	Unstandardized Coefficient (SE)
STRS comfort -> Relationship	.22 (.06)	1***
STRS struggle -> Relationship	-.57 (.05)	-2.06 (.44)***
STRS physical affection -> Relationship	-.31 (.08)	-1.08 (.23)***
STRS angry -> Relationship	-.62 (.05)	-2.79 (.79)***
STRS bad mood -> Relationship	-.71 (.04)	-3.17 (.77)***
STRS in tune -> Relationship	.15 (.07)	.67 (33)*
CIS Detached -> Interaction	.60 (.04)	1***
CIS Harsh -> Interaction	.71 (.04)	2.37 (.24)***
CIS Permissive -> Interaction	.71 (.04)	.97 (.10)***
CIS Sensitivity -> Interaction	.84 (.02)	4.66 (.42)***
ECERS-R Language and Talking -> Interaction	.81 (.02)	1.00 (.10)***
ECERS-R Learning Activities -> Interaction	.62 (.03)	.68 (.09)***
ECERS-R Interactions -> Interaction	.86 (.02)	1.07 (.10)***
CIS Harsh*CIS Permissive	.68 (.04)	1.97 (.40)***
Relationship*Interaction	-.02 (.05)	.00 (.01)

***=p<.001

Figure 2. Early Childhood Longitudinal Study-Birth Cohort Confirmatory Factor Analysis Two-factor Solution



Head Start Family and Child Experience Survey. Unfortunately, the FACES data has to be handled slightly differently, as only one indicator is available for teacher–child relationship. Though SEM CFA including the relationship variable could not be modeled, principal components analysis suggests that a two-factor solution is the best. Principle components analysis indicates a single-factor solution with only one eigenvalue above 1.0 (3.03). Review of principal axis factoring with varimax rotation indicates that the teacher–child relationship variable does not load on this single factor (.04). There is clear support for distinguishing the teacher–child relationship variable as separate; the alpha for the teacher–child interaction items is .69. The lowest loading on this factor is the Caregiver Interaction Scale Independence subscale, but it is retained because removing it does not improve internal consistency (α=.69)

Table 13. FACES 2006 Weighted Factor Score Loadings for Teacher–Child Interpersonal Dynamics

	Relationships	Interactions
TCR	1	-
CIS Detach	-	0.57
CIS Harsh	-	0.72
CIS Independence	-	-0.33
CIS Permissive	-	0.74
CIS Sensitive	-	0.83
CLASS IS	-	0.63
ECERS-R Teaching	-	0.79

RQ 2: How do teacher–child classwide interactions and teacher–child dyadic relationships uniquely contribute to children's academic outcomes and classroom behaviors when accounting for both dynamics?

HSIS.

Prekindergarten Academic Models. Given the theoretical and statistical support for the distinction of teacher–child relationships and teacher–child classwide interactions, structural equation models were fit to analyze the relationships among these two interpersonal dynamics and children's academic achievement, as indicated by their reading (WJ3 Letter/Word) score and math (WJIII Applied Problems) scores in the spring of their prekindergarten year. The following covariates were included in this model: child race, home language, household income, mother's highest level of education, special needs, age, sex, child's temperament, and classroom child–staff ratio. Weighted factor scores were created for the suggested factors of teacher–child relationship and teacher–child interaction by using the CFA coefficients. This reduced the complexity of interpreting moderation models.

The model discussed above, depicted in Figure 3, achieved good fit with an SRMR of 0.000 and explained approximately 29% of the variance in children's reading and math scores. For children's pre-literacy score, as indicated by the WJ3word/letter score, TCR approached significance ($\beta = .08$, $p < .10$; standardized coefficients reported); however, TCI did not. Other significant predictors included children having a diagnosed special need ($\beta = -.14$, $p < .01$), child gender ($\beta = .11$, $p < .05$), mother's highest level of education ($\beta = .11$, $p < .05$), and child being non-Hispanic black ($\beta = .26$, $p < .01$) or non-Hispanic white/other ($\beta = .17$, $p < .05$) in comparison to Hispanic/Latino. This finding

regarding teacher–child relationships can be interpreted as indicating that children with more positive relationships with their teachers scored higher on the assessment of word/letter knowledge; however, this should be interpreted with caution as the p-value was equal to .05. Additionally, other control variables significant associated with children's reading were identified special needs and gender, such that children who did not have an identified special need and girls scored higher on WJ3 word/letter.

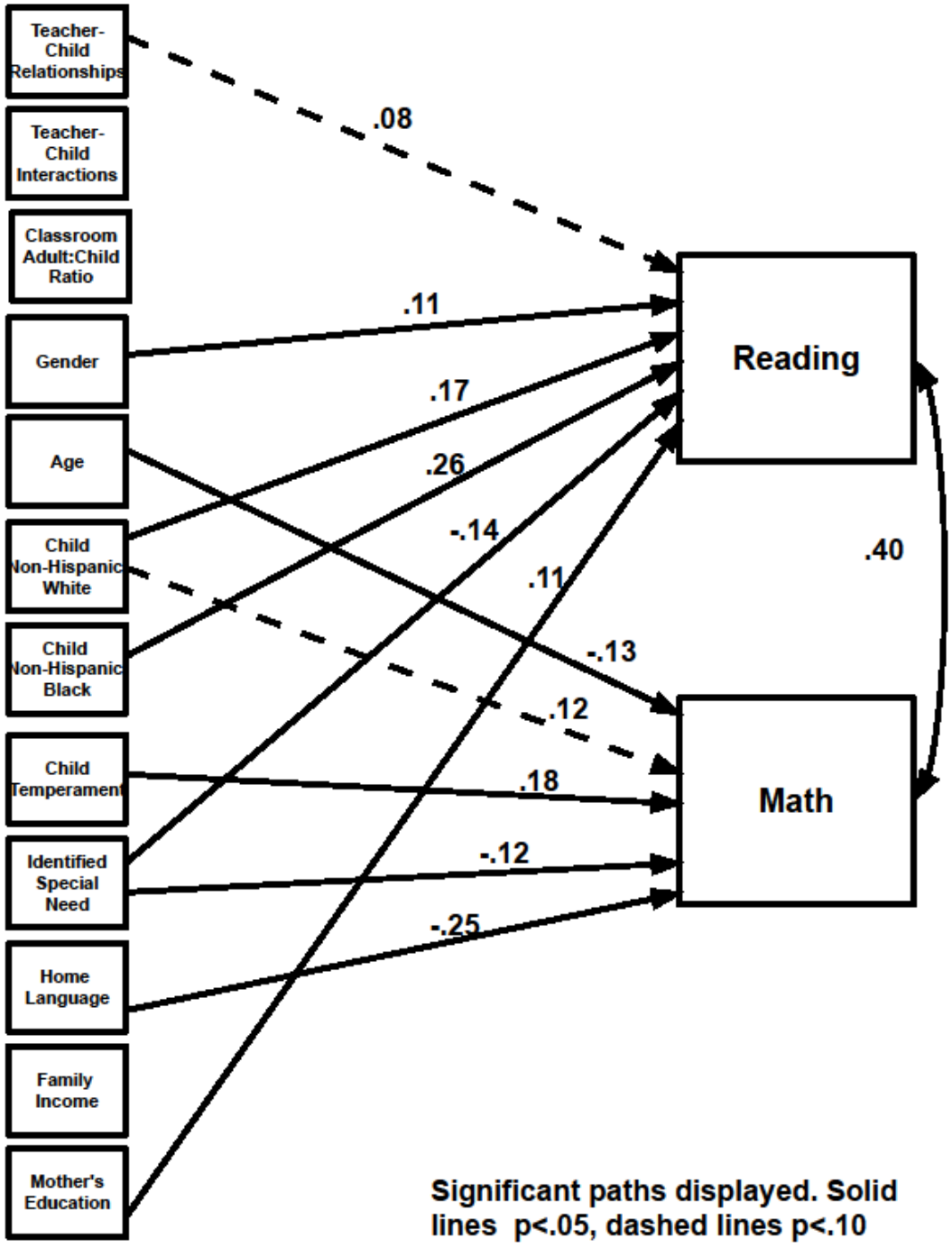
Neither TCR, nor TCI were significantly associated with children's math achievement. Significant control variable include children's home language ($\beta = .25$, $p < .01$), having a special need ($\beta = -.12$, $p < .05$), temperament ($\beta = .18$, $p < .01$), and age ($\beta = -.13$, $p < .05$). Results regarding these control variables can be interpreted as indicating that children who spoke English as a home language, children who did not have a diagnosed special need, children with easier-going temperaments, and boys scored higher.

Table 14. HSIS Structural Equation Model of Prekindergarten Reading and Math

SMRS= 0.00	Reading		Math	
CD= 0.291	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized
Teacher–Child Relationship	.04t (.02)	.08	.02 (.03)	.04
Teacher–Child Classwide Interactions	.01 (.02)	.03	.02 (.02)	.07
Adult–Child Ratio	.15 (.28)	.03	-.03 (.31)	-.01
Gender	3.19* (1.31)	.11	-.32 (1.87)	-.01
Age	-2.70 (1.91)	-.09	-3.88* (1.61)	-.13
Child non-Hispanic White	5.47* (2.30)	.17	4.08t (2.15)	.12
Child non-Hispanic Black	8.38*** (2.92)	.26	-.87 (1.91)	-.03
Child Temperament	.20 (.12)	.08	.42** (.13)	.18
Identified Special Need	-5.81** (1.96)	-.14	-5.24* (2.39)	-.12
Home Language	-1.74 (2.51)	-.05	-8.59** (2.75)	-.25
Family Income	.49 (.51)	.05	.55 (.53)	.05
Mother Education	2.03* (.87)	.11	1.58 (.96)	.08
Constant	89.10*** (.03)	5.96	80.84*** (7.95)	5.22

*=p<.05, **=p<.01, ***=p<.001

Figure 3. HSIS Structural Equation Model of Prekindergarten Reading and Math



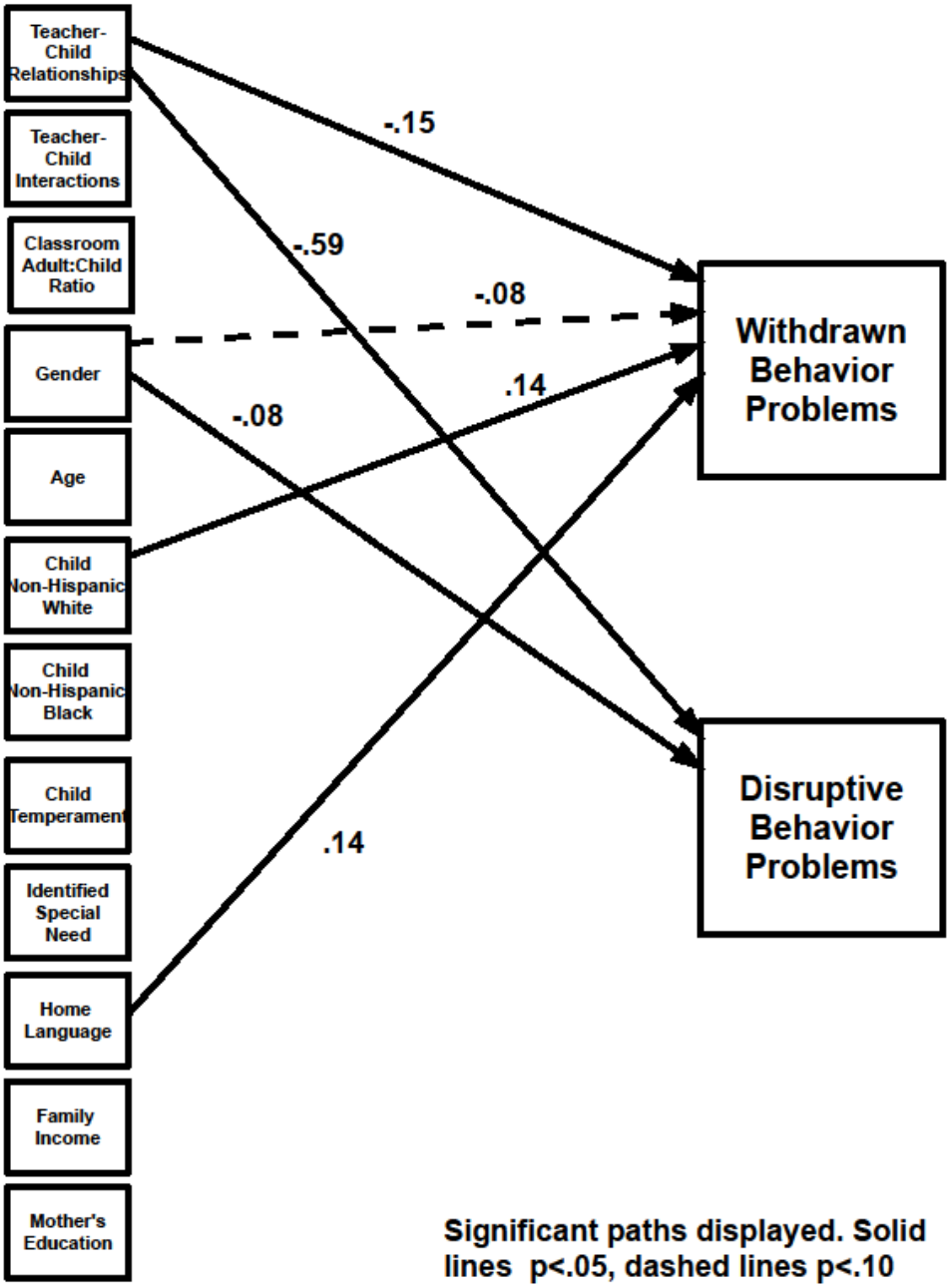
Prekindergarten classroom behavior models. In regard to classroom behavior outcomes, a single model was fit analyzing associations between teacher–child interpersonal dynamics and children's withdrawn and disruptive classroom behavior problems (see Figure 4). Good fit was indicated with an SRMR value of 0.00, and the model explained about 45% of the variance in behavior scores. In this model, TCR was significantly associated with internalizing behavior problems ($\beta = -.15$, $p < .05$), suggesting that children with more positive relationships with teachers are rated as having fewer withdrawn behavior problems; classwide interactions were not associated with this outcome. Additionally, the child being white ($\beta = .14$, $p < .05$), as compared to Hispanic/Latino, and home language ($\beta = -.14$, $p < .05$) were related to withdrawn behavior problems, suggesting that children whose primary language was a language other than English were rated as having more withdrawn behavior problems than children who spoke English as a home language, and non-Hispanic white children had more withdrawn behavior problems than Hispanic children. Similarly, teacher–child relationships were significantly associated with disruptive behavior problems ($\beta = -.59$, $p < .001$), but classwide interactions were not. Children with less positive relationships with their teachers were rated as having more disruptive behavior problems. Additionally, child gender was significantly related to disruptive behavior problems such that boys had higher scores ($\beta = -.08$, $p < .05$).

Table 15. HSIS Structural Equation Model of Prekindergarten Classroom Behavior

SMRS= 0.00	Withdrawn Problem Behaviors		Disruptive Problem Behaviors	
CD= 0.45	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized
Teacher–Child Relationship	-.03** (.01)	-.15	-.15*** (.01)	-.59
Teacher–Child Interactions	.01 (.01)	.06	-.004 (.01)	-.03
Classroom Adult–Child Ratio	.20 (.12)	.09	.03 (.15)	.01
Gender	-.92t (.49)	-.08	-1.15* (.57)	-.08
Age	-.46 (.58)	-.04	-.68 (.42)	-.05
Child non-Hispanic White	1.76* (.85)	.14	-.15 (.81)	-.01
Child non-Hispanic Black	-.02 (.83)	.00	.60 (.85)	.04
Child Temperament	.02 (.03)	.02	-.05 (.03)	-.05
Identified Special Need	.75 (1.17)	.05	.85 (.78)	.04
Home Language	1.83* (.89)	-.14	-.54 (.80)	.03
Family Income	-.2 (.19)	-.06	.07 (.15)	.01
Mother Education	.08 (.39)	.01	.47 (.35)	.05
Constant	47	8.20	54.17*** (2.75)	7.47

*=p<.05, **=p<.01, ***=p<.001

Figure 4. HSIS Structural Equation Model of Prekindergarten Classroom Behavior



Kindergarten models. The previously discussed models were also run for children's academic and behavior outcomes in their kindergarten year. Neither teacher–child relationships nor teacher–child interaction in the prekindergarten year were related to children's reading, math, or withdrawn behavior problems during the kindergarten year. However, prekindergarten teacher–child relationships were significantly associated with children's kindergarten disruptive behavior problems ($\beta = -.37$, $p < .001$), with those children with less positive relationships having more disruptive behavior problems. Tables for HSIS Kindergarten models are displayed below (Table 14 & 15).

Table 16. HSIS Structural Equation Model of Kindergarten Reading and Math

SMRS= 0.00	Reading		Math	
CD= 0.191	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized
Teacher–Child Relationship	.00 (.02)	.01	.03 (.02)	.07
Teacher–Child Classwide Interactions	.01 (.02)	.03	.00 (.01)	.00
Classroom Adult–Child Ratio	.08 (.27)	.02	-.20 (.24)	-.04
Gender	2.50t (1.45)	.09	.01 (1.15)	.00
Age	-4.66** (1.30)	-.17	-3.12t (1.58)	-.11
Child non-Hispanic White	-.45 (3.34)	-.02	3.66* (1.67)	.12
Child non-Hispanic Black	.18 (2.95)	.01	-1.26 (1.85)	-.04
Child Temperament	.23* (.10)	.11	.42** (.14)	.19
Identified Special Need	-4.95* (1.92)	-.13	-6.47** (2.13)	-.16
Home Language	-1.82 (2.69)	.06	-2.23 (2.56)	.07
Family Income	.22 (.54)	.02	.39 (.50)	.04
Mother's Education	1.91* (.82)	.12	2.22** (.64)	.13
Constant	114.93 (7.45)	8.47	96.96*** (10.91)	6.75

*=p<.05, **=p<.01, ***=p<.001

Table 17. SEM Model of HSIS Kindergarten Classroom Behavior

	Withdrawn Problem Behavior		Disruptive Problem Behavior	
	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized
Teacher–Child Relationship	.00 (.01)	-.02	-.09*** (.01)	-.37
Teacher–Child Classwide Interactions	.01 (.01)	.08	.00 (.01)	-.01
Classroom Adult–Child Ratio	.21 (.17)	.09	-.05 (.18)	-.02
Gender	-.25 (.73)	-.02	1.80* (.83)	-.13
Age	-.76 (.58)	-.06	-.58 (.73)	-.04
Child non-Hispanic White	-.35 (1.22)	-.03	-.65 (.85)	-.05
Child non-Hispanic Black	-1.16 (1.25)	-.08	-.50 (.77)	-.03
Child Temperament	-.13* (.05)	-.13	.00 (.05)	.00
Identified Special Need	1.21 (.90)	.07	-.29 (.82)	-.02
Home Language	-.33 (1.09)	.02	-2.91** (.87)	.20
Family Income	-.30 (.20)	-.07	-.31 (.27)	-.07
Mother's Education	.10 (.47)	.01	-.11 (.31)	-.01
Constant	52.56*** (4.29	8.46	53.38*** (4.23)	7.94

*=p<.05, **=p<.01, ***=p<.001

ECLS-B.

***Prekindergarten academic models*.** Given that the investigators for the ECLS-B constructed their own math and reading scales from a number of other instruments, these are the academic outcomes used in analyzing this dataset. Models similar to those in the HSIS were run examining the associations among relationships and interactions and

children's outcome variables. Control variables included the teacher–child ratio in the prekindergarten classroom, the child's age, race, home language, temperament, presence of an identified special need, family income, and the mother's highest level of education.

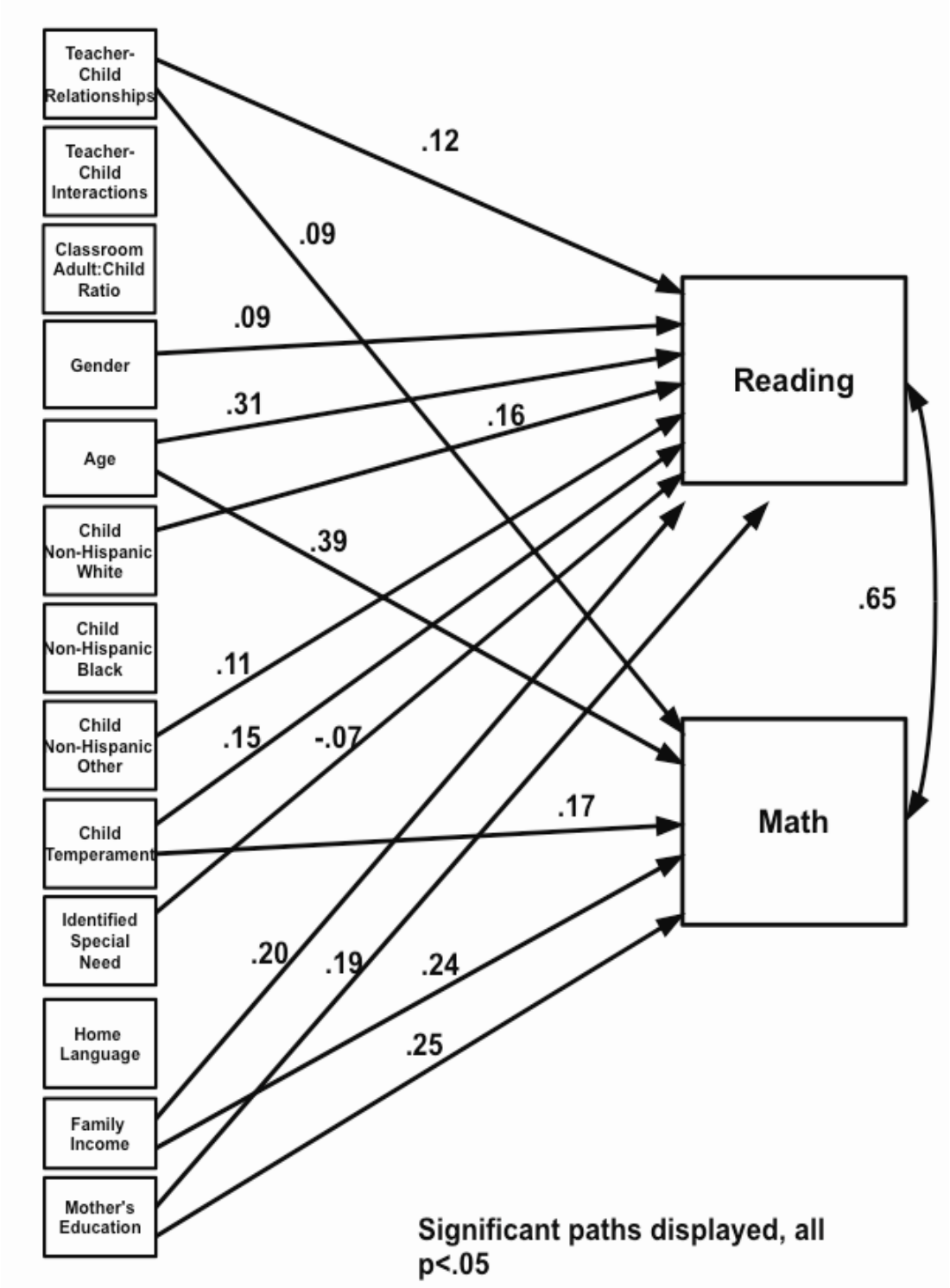
The model for prekindergarten academics achieved good fit (SMRS=0.00) and explained 43% of the variance in academic scores. Teacher–child relationships were significantly positively associated with both reading ($\beta = .12$, $p < .01$) and math ($\beta = .09$, $p < .05$) scores. Children with more positive teacher–child relationships scored higher on math and reading composites. However, classwide interactions were not significantly related to either. Other significant predictors of children's reading scores included mother's highest level of education ($\beta = .19$, $p < .001$), family income ($\beta = .20$, $p < .001$), child's age ($\beta = .31$, $p < .001$), child's gender ($\beta = .09$, $p < .05$), child having a diagnosed special need ($\beta = -.07$, $p < .01$), child's temperament ($\beta = .15$, $p < .01$) and the child's race (non Hispanic white: $\beta = .16$, $p < .05$; other: $\beta = .11$, $p < .001$). Other significant predictors of children's math scores were child's age ($\beta = .39$, $p < .001$), child temperament ($\beta = .17$, $p < .001$), family income ($\beta = .24$, $p < .001$), and mother's highest level of education ($\beta = .25$, $p < .001$).

Table 18. ECLS-B Structural Equation Model of Prekindergarten Reading and Math

SMRS= 0.00	Reading		Math	
CD= 0.43	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized
Teacher–Child Relationship	.37** (.11)	.12	.25* (.10)	.09
Teacher–Child Classwide Interactions	.00 (.01)	-.02	.00 (.01)	.00
Classroom Adult–Child Ratio	.19 (.15)	.05	.17 (.11)	.05
Gender	1.96* (.91)	.09	.99 (.71)	.05
Age	.85*** (.10)	.31	.96*** (.08)	.39
Child non-Hispanic White	3.40* (1.39)	.16	.44 (1.10)	.02
Child non-Hispanic Black	.59 (1.16)	.02	-.37 (1.03)	-.01
Child non-Hispanic Other	4.77*** (1.31)	.11	1.82 (1.21)	.05
Child Temperament	1.91** (.53)	.15	1.96*** (.39)	.17
Identified Special Need	-3.31** (1.20)	-.07	-1.08 (1.62)	-.03
Home Language	-1.00 (1.08)	-.03	-.22 (.85)	-.01
Family Income	.89*** (.10)	.20	.95*** (.18)	.24
Mother's Education	2.99*** (.81)	.19	3.51*** (.60)	.25
Constant	-37.18*** (6.05)	-3.50	-38.40*** (5.11)	-4.00

*=p<.05, **=p<.01, ***=p<.001

Figure 5. ECLS-B Structural Equation Model of Prekindergarten Reading and Math



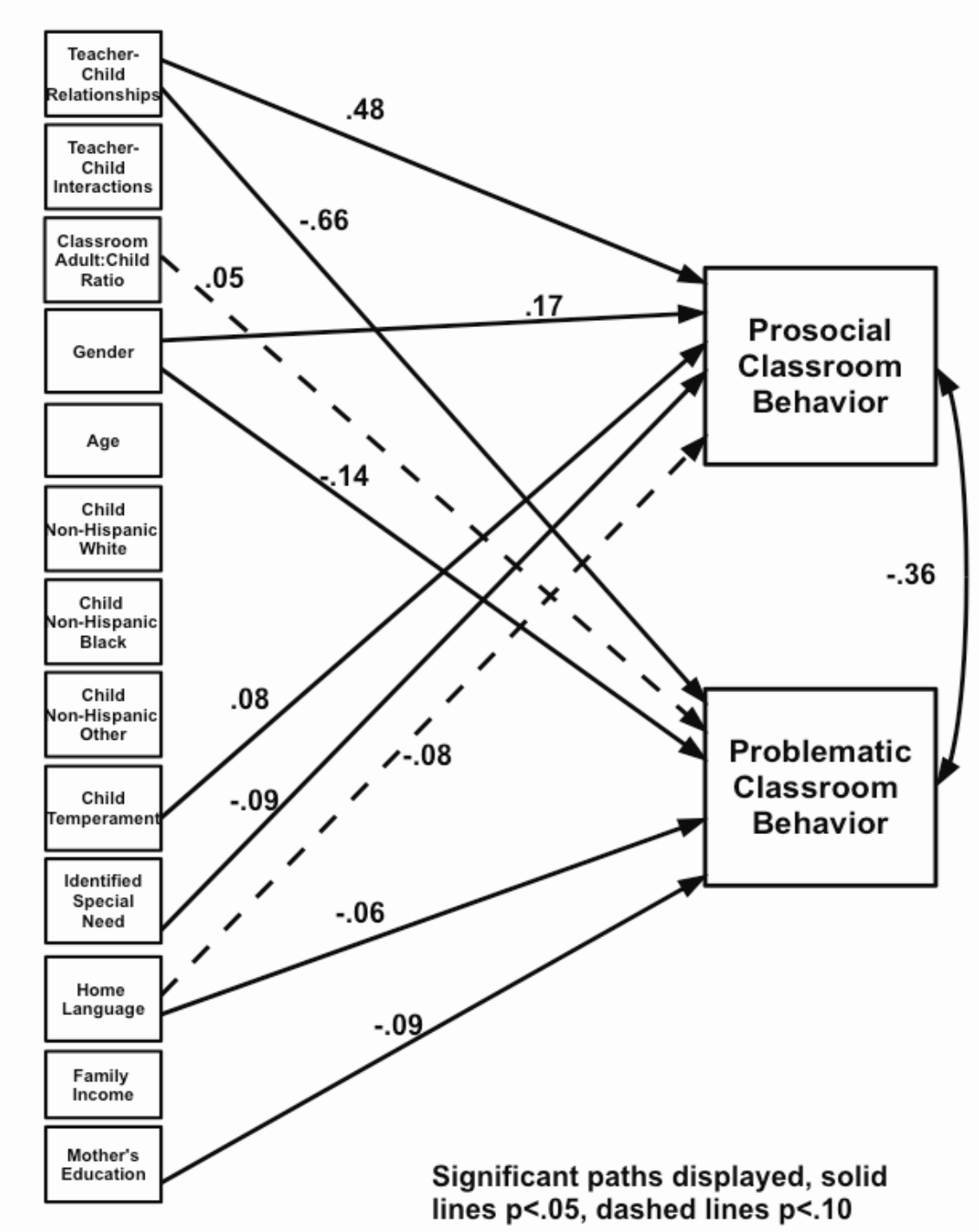
Prekindergarten behavior models. The model for prekindergarten classroom behaviors also achieved good fit (SMRS=0.00) and explained 55% of the variance in teacher ratings of children's classroom behaviors. Unlike the HSIS, the ECLS-B provides indicators of both pro-social and problematic behavior. Teacher–child relationships were significantly associated with both prosocial behavior ($\beta = .48$, $p < .001$) and problematic behavior ($\beta = -.66$, $p < .001$). Again, teacher–child classwide interactions were not associated with either. Other significant predictors of children's prosocial behavior include children's gender ($\beta = .17$, $p < .001$), children's temperament ($\beta = .08$, $p < .01$), and children having an identified special need ($\beta = -.09$, $p < .05$). In other words, girls, children with temperaments rated as more positive/compliant, and children who do not have a diagnosed special need are rated as having more positive classroom behavior. Other significant predictors of children's problematic behaviors include mother's highest level of education ($\beta = -.09$, $p < .05$), child's gender ($\beta = -.14$, $p < .001$), and child's home language ($\beta = -.06$, $p < .05$). These results indicate that boys, children whose mothers have less education, and children whose home language is English are rated as having more problematic behavior.

Table 19. ECLS-B Structural Equation Model of Prekindergarten Classroom Behavior Model

SMRS= 0.00	Prosocial Classroom Behavior		Problematic Classroom Behavior	
CD= 0.55	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized
Teacher–Child Relationship	.08 (.01)***	.48	-.14*** (.01)	-.66
Teacher–Child Classwide Interaction	.00 (.00)	.00	.00 (.00)	-.01
Classroom Adult–Child Ratio	-.01 (.01)	-.04	.01t (.01)	.05
Age	.01 (.01)	.08	.00 (.01)	-.02
Gender	.19*** (.05)	.17	-.22 (.05)***	-.14
Child non-Hispanic White	-.11 (.10)	-.09	.00 (.07)	.00
Child non-Hispanic Black	-.13 (.09)	-.08	-.03 (.07)	-.01
Child non-Hispanic Other	-.03 (.09)	-.01	.07 (.08)	.02
Child Temperament	.05** (.02)	.08	.00 (.02)	.00
Indentified Special Needs	-.2* (.10)	-.09	.09 (.13)	.03
Home Language	-.13t (.08)	-.08	-.13* (.06)	-.06
Family Income	.01 (.01)	.06	-.01 (.01)	-.04
Mother Education	.06 (.04)	.07	-.10* (.05)	-.09
Constant	2.82*** (.36)	5.01	2.60*** (.34)	3.92

*=p<.05, **=p<.01, ***=p<.001

Figure 6. ECLS-B Structural Equation Model of Prekindergarten Classroom Behavior Model



Kindergarten models. In regard to the kindergarten models, neither relationships nor interactions were significantly associated with children's academic outcomes. However, as was the case with the HSIS, the prekindergarten teacher–child relationship is significantly related to the kindergarten teacher's report of children's classroom behavior. Children who had more positive relationships with their prekindergarten teachers were rated higher on prosocial classroom behaviors by their kindergarten teachers ($\beta = .24$, $p < .001$) and lower on problematic classroom behaviors ($\beta = -.34$, $p < .001$). Interestingly, the quality of classwide interactions in children's prekindergarten classroom was also significantly associated with their kindergarten teachers' rating of their problematic classroom behavior ($\beta = -.11$, $p < .05$) (see Tables 18 & 19).

Table 20. ECLS-B SEM model K Academic Outcomes

SMRS= 0.00 CD= 0.40	Reading		Math	
	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized
Teacher–Child Relationship	.29 (.21)	.07	.12 (.11)	.05
Teacher–Child Interactions	.00 (.01)	-.01	.00 (.01)	.00
Classroom Adult–Child Ratio	.09 (.24)	.02	-.06 (.14)	-.02
Gender	1.78t (1.06)	.06	.59 (.74)	.03
Age	1.48*** (.20)	.36	.97*** (.11)	.36
Child non-Hispanic White	2.20 (4.73)	.08	2.49 (2.27)	.13
Child non-Hispanic Black	-.92 (3.45)	-.02	-.28 (1.83)	-.01
Child non-Hispanic Other	2.33 (3.77)	.04	2.37 (1.98)	.07
Child Temperament	1.22 (.75)	.07	.62t (.38)	.05
Identified Special Need	-9.64** (2.71)	-.16	-3.39** (1.12)	-.09
Home Language	1.14 (3.16)	.03	.82 (1.66)	.03
Family Income	1.28*** (.31)	.22	.79*** (.21)	.21
Mother's Education	3.92** (1.07)	.19	2.92*** (.68)	.21
Constant	-71.82*** (16.18)	-5.01	-32.97*** (8.14)	-3.49

*=p<.05, **=p<.01, ***=p<.001

Table 21. ECLS-B SEM Kindergarten Classroom Behavior Model

SMRS= 0.00	Prosocial Classroom Behavior		Problem Classroom Behavior	
CD= 0.31	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized
Teacher–Child Relationship	.04*** (.01)	.24	-.07*** (.01)	-.34
Teacher–Child Interactions	.00 (.00)	-.01	-.002 * (.001)	-.11
Classroom Adult–Child Ratio	.01 (.01)	.04	.02 (.01)	.07
Gender	.20** (.06)	.15	-.34*** (.06)	-.24
Age	-.01 (.01)	-.03	.00 (.01)	-.01
Child non-Hispanic White	-.06 (.09)	-.05	-.11 (.10)	-.08
Child non-Hispanic Black	-.09 (.10)	-.05	-.02 (.11)	-.01
Child non-Hispanic Other	-.03 (.10)	-.01	-.05 (.10)	-.02
Child Temperament	.03 (.04)	.03	-.02 (.04)	-.02
Identified Special Need	-.13 (.14)	-.05	.30* (.12)	.11
Home Language	-.03 (.11)	-.02	-.23* (.10)	-.12
Family Income	.04* (.02)	.14	-.02 (.02)	-.09
Mother's Education	.08 (.07)	.08	-.06 (.05)	-.06
Constant	3.91*** (.59)	5.85	2.82*** (.72)	3.95

*=p<.05, **=p<.01, ***=p<.001

FACES. Using multilevel modeling, the FACES data affords the opportunity for examining the proportion of variance associated with between-classroom differences and within-classroom differences. There are a number of variables related to each, but of the primary independent variables of interest, teacher–child interaction scores would indicate differences in experiences between classrooms. Teacher–child relationship scores would indicate differences in experiences within classrooms. For this dataset, each multilevel

model is predicting only one outcome score. It is important to keep in mind with all FACES results that children's mothers reported the teacher–child relationship in this dataset.

Prekindergarten academic models. Unlike the other two datasets, teacher–child relationships were not significantly related to either of children's academic outcomes. Covariates significantly related to children's WJIII-Letter/Word subscale were child's age (presented in unstandardized coefficients) (b = -4.66, p <.001), being African American (compared to Hispanic) (b = 6.87, p <.05), mother's education (b = 2.22, p <.01), and child's temperament (b =.24, p <.001), and 49% of the variance was between classrooms. Covariates significantly related to children's WJIII-Applied score include being white (b = 6.85, p <.01), child's age (b = -3.70, p <.001), child's age (b = -3.70, p <.001), mother's education (b = 2.54, p <.001), child having a diagnosed special need (b = -12.91, p<.05), and children's temperament (b = .25, p <.001). Fifty-one percent of the variance in this model was attributable to between classroom differences.

Table 22. FACES 2006 MLM Prekindergarten Models

	Reading	Math	Positive Behavior	Problematic Behavior
Intercept	71.51*** (7.55)	70.54*** (6.60)	12.50*** (2.03)	15.50*** (3.16)
Teacher–Child relationship	.83 (1.44)	-.30 (1.14)	.34 (.38)	-.60 (.49)
Classroom				
Teacher–Child Classwide Interactions	-.02 (.09)	-.09 (.08)	.03 (.03)	-.03 (.04)
Classroom Adult–Child Ratio	.24 (.37)	.11 (.33)	.03 (.12)	-.09 (.16)
Child Characteristics				
Gender	2.05 (1.27)	.40 (1.22)	1.06*** (.29)	-1.78*** (.37)
Age	-4.66*** (1.09)	-3.70*** (1.01)	.49t (.26)	-.53t (.31)
Child non-Hispanic White	1.19 (2.43)	6.85** (2.25)	-.75 (.62)	2.62*** (.68)
Child non-Hispanic Black	6.87* (3.14)	-.17 (2.38)	-.61 (.60)	1.40* (.57)
Child non-Hispanic Other	3.11 (2.64)	3.42t (1.89)	-.69 (.79)	.60 (.80)
Child Temperament	.24*** (.04)	.25*** (.04)	.06*** (.01)	-.11*** (.02)
Identified Special Need	-5.88t (3.31)	-12.91* (5.51)	-1.66t (.97)	2.89t (1.55)
Home Language	1.88 (1.88)	-2.82 (1.97)	.06 (.53)	-.28 (.59)
Family Income	.26 (.36)	.57 (.38)	-.23* (.11)	.16 (.12)
Mother's Education	2.22** (.73)	2.54*** (.72)	.07 (.26)	.11 (.31)
Random Effects Components				
Identity (cons)	111.80 (9.82)	94.754 (13.74)	10.94 (.90)	22.71 (2.82)
ID (Residual)	100.87 (7.10)	89.511 (6.93)	6.47 (.66)	10.80 (1.13)
Log Likelihood	-469483.52	-461960.15	-296722.55	-328986.10

t=p<.10, *=p<.05, **=p<.01, ***=p<.001

Prekindergarten behavior models. Much like the ECLS-B, classroom behaviors are indicated in terms of both prosocial behaviors and problematic behaviors. In regard to the model predicting children's prosocial scores, 38% of the variance lies between classrooms. However, neither teacher–child relationships nor teacher–child interactions were significantly associated with children's prosocial behaviors. Covariates related to prosocial behaviors include gender (b = 1.06, p <.001), child's temperament (b = .06, p <.001), and household income (b = -.23, p <.05).

Unlike the other two datasets, children's problematic behavior was not significantly predicted by the teacher–child relationship. Significant predictors of children's negative classroom behavior included gender (b = -1.78, p <.001), child being white (b = 2.62, p <.001), child being black (b = 1.40, p <.05), and child's temperament (b = -.11, p <.001). Teacher–child interactions was not significantly related to either. In this model, 37% of the variance was related to between classroom differences.

This consistent lack of significant associations between teacher–child relationships and children's outcomes in the FACES sample may be a reflection of the method of measuring teacher–child relationship through maternal report on the child's experience. In other words, these models might really reflect how parents' satisfaction with their child's Head Start experience is related to children's outcomes. This allows for characteristics of parents that would account for both their satisfaction or perception of their children's experience and those children's outcomes to influence the findings. In an effort to determine the extent to which this was occurring correlations between parental report of the teacher–child relationships and both parental depression and household

income were examined; none were found to be significant. Further, as mentioned above, this variable was highly skewed so the variance was limited.

Kindergarten models. Similar models were run regarding each dependent variable during the spring of the child's kindergarten year (or year after prek). Neither prekindergarten teacher–child relationships nor interactions were significantly related to children's WJIII-Applied, WJIII-Letter/Word, or prosocial behavior scores at the end of kindergarten. Interestingly, children's problem classroom behavior, as reported by the kindergarten teacher, was significantly associated with the child's relationship with the prekindergarten teacher (b = -2.33, p <.05). Overall, analyses from the FACES dataset do not dispute conclusions drawn from the other datasets to answer the research questions at hand, but add little.

Table 23. FACES 2006 MLM Kindergarten Models

	Reading	Math	Positive Behavior	Problematic Behavior
Intercept	171.81*** (11.98)	1168.20*** (15.47)	-1.78 (7.35)	43.19*** (8.98)
Teacher–Child Relationship	.96 (1.18)	1.80 (1.52)	1.13 (1.02)	-2.33* (1.07)
Classroom				
Teacher–Child Classwide Interactions	-.08 (.09)	-.15 (.10)	.01 (.03)	.05 (.05)
Classroom Adult–Child Ratio	-.15 (.35)	-0.04 (.42)	.06 (.15)	-.05 (.22)
Child Characteristics				
Gender	.58 (1.33)	-2.13 (1.75)	1.82** (.60)	-2.63** (.86)
Age	-1.15*** (.13)	-.61** (.18)	.21** (.08)	-.36*** (.10)
Child non-Hispanic White	-.37 (2.14)	-1.26 (4.03)	-2.74* (1.07)	3.76* (1.55)
Child non-Hispanic Black	2.45 (2.60)	-2.05 (3.58)	-1.96 (1.66)	3.48* (1.72)
Child non-Hispanic Other	1.71 (2.38)	-5.88 (4.37)	-.19 (1.24)	-1.93 (1.93)
Child Temperament	.20*** (.04)	.27*** (.04)	.02 (.02)	-.06** (.02)
Identified Special Need	-10.90* (5.12)	-8.08* (3.18)	-3.34t (1.74)	5.34* (2.39)
Home Language	1.38 (1.83)	-1.71 (1.96)	-.72 (1.41)	-.17 (1.53)
Family Income	.51 (.43)	.90t (.51)	.17 (.27)	-.34 (.35)
Mother's Education	2.58** (.81)	2.86*** (.86)	-1.01** (.37)	1.20** (.44)
Random Effects Components				
Identity (cons)	89.46 (8.72)	118.20 (16.76)	12.26 (1.37)	27.46 (3.37)
ID (Residual)	69.60 (7.09)	99.53 (10.96)	8.92 (1.08)	12.75 (1.61)
Log Likelihood	-361286.02	-380269.30	-171161.40	-183324.99

*=p<.05, **=p<.01, ***=p<.001

RQ3. Do teacher–child classwide interactions moderate the association between teacher–child relationships and children's outcomes?

It was hypothesized that teacher–child interactions would moderate the association between teacher–child relationships and children's outcomes. The hypothesis was that a child with a positive relationship in a classroom of high quality interactions might access more of the benefits of those interactions while a child with a positive relationship in a classroom with low quality interactions would benefit less because they would be accessing low quality interactions. In other words, the benefits of positive relationships would be more beneficial in higher quality classrooms and less beneficial in lower quality classrooms. To determine if the associations among teacher–child relationships and children's outcome variables were moderated by the classwide interaction quality, a product term of teacher–child relationship by teacher–child interaction was created in each dataset and added to the original models for each outcome discussed above. This product term was non-significant in all models in the Head Start Impact Study as well as the ECLS-B. There are two trend-level product terms in the FACES 2006, one in regard to prekindergarten prosocial behavior and one in relation to kindergarten math. These are displayed below (see Figure 7 and Figure 8); however, given the large number of models tested and the lack of other significant findings, these findings are not further interpreted. In regard to the association between children's teacher–child relationship and prekindergarten positive behavior, teacher–child interactions moderated the association such that positive relationships were associated with more positive behavior for children in higher quality classrooms, but less positive

behavior for children in lower quality classrooms (see Figure 7). The association between children's prekindergarten teacher–child relationships and children's prekindergarten math scores were moderated by classwide interaction quality such that the association was slightly negative for children in the highest quality classrooms, positive for children in average quality classrooms, and slightly positive for children in the lowest quality classrooms. Note that the most variance in math scores across the three classrooms occurs where children have the least positive relationships.

Figure 7. FACES 2006 Moderation by Teacher–Child Interactions on Association between Teacher–Child Relationships and Prekindergarten Positive Behavior

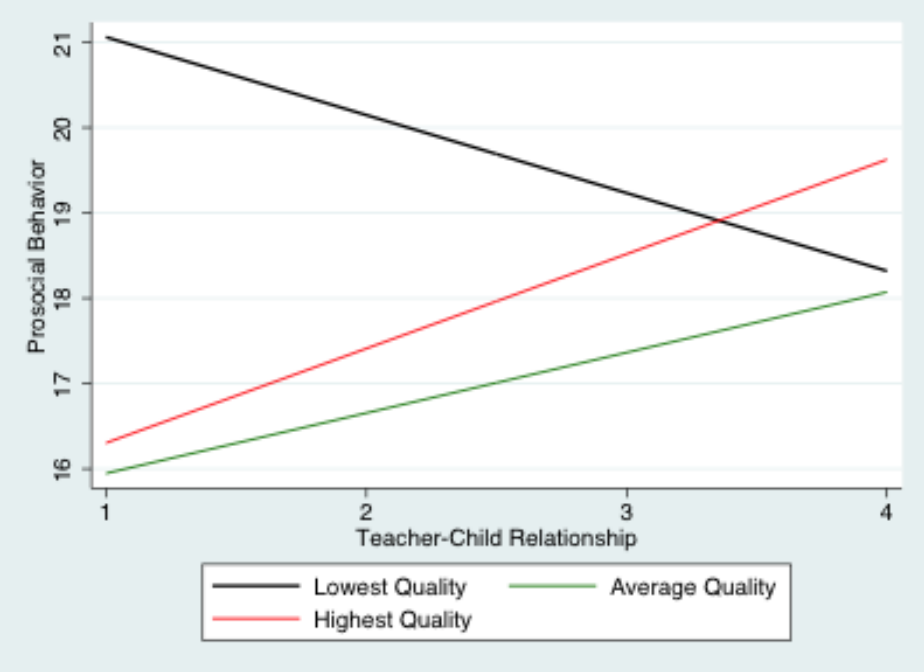
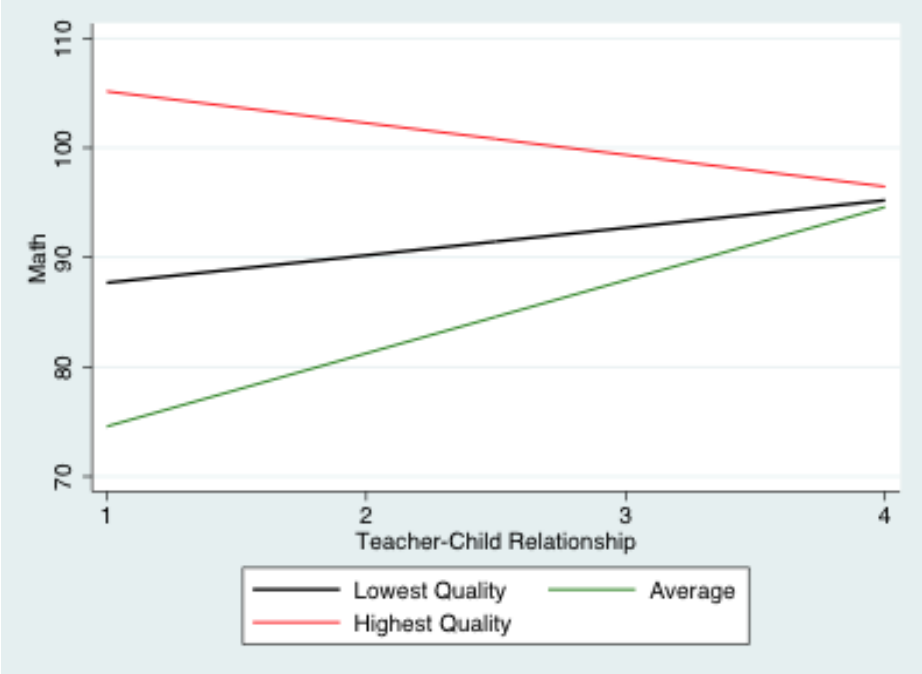


Figure 8. FACES 2006 Moderation by Teacher–Child Interactions on Association between Teacher–Child Relationships and Prekindergarten Math



Structural equation modeling is not particularly well suited to analyses involving the statistical interaction of two variables, which is problematic for both the HSIS and ECLS-B datasets (Kline, 2011). As such, exploratory multigroup analyses were run post hoc, and are discussed following the results of analyses addressing research question four.

RQ4. Does children's temperament moderate the associations between either prekindergarten teacher–child relationships or prekindergarten teacher–child classwide interactions and children's outcomes?

The primary interest regarding children's temperament in this study was how temperament might moderate associations between teacher–child interpersonal dynamics and children's outcomes. A statistical interaction of classroom quality and temperament in relation to children's outcomes has been previously identified (Vitiello et al., 2012), but from the perspective of classroom quality moderating temperament—outcome associations. The aim in the current study was to explore the moderation of associations between teacher–child interpersonal dynamics and children's outcomes by children's temperaments. However, it is worth noting that temperament had a significant main effect in several of the models. In fact, temperament was significantly associated with all prekindergarten and kindergarten academic outcomes except reading in the HSIS. Temperament was also significantly associated with children's prekindergarten positive classroom behavior in both the ECLS-B and FACES, and with problematic behavior in the FACES. Temperament was significantly associated with children's kindergarten withdrawn classroom behavior in the HSIS and problematic classroom behavior in the FACES.

To determine if the associations among teacher–child relationships and children's outcomes or teacher–child interactions and children's outcomes were moderated by children's temperament, product term variables were created using the product of children's temperament and teacher–child relationships and by children's temperament

and teacher–child interactions (Kline, 2011). Several significant statistical interactions were identified. In the ECLS-B dataset, temperament moderated the association between teacher–child relationships and children's prekindergarten reading (see Figure 9) and teacher–child classwide interactions and kindergarten math scores (Figure 10). In reviewing the graphs below, it is helpful to keep in mind that Group 1 had the lowest temperament score, indicating less engaged, less sociable, and less positive affect. Group 3 had the highest temperament scores, indicating that these children were more engaged, more sociable, and had more positive during direct assessments. It appears that children's temperament moderated the association between teacher–child relationships and children's reading scores such that children with easier to engage temperaments benefitted the most from more positive teacher–child relationships in relation to reading scores. In contrast, temperament moderated the association between teacher–child classwide interactions and children's math scores such that children with more difficult to engage temperaments seem to benefit the most from higher quality prekindergarten teacher–child classwide interactions, at least in regard to kindergarten math achievement.

Figure 9. ECLS-B Moderation of the Association Between Teacher–Child Relationships and Prekindergarten Reading Skills by Child's Temperament

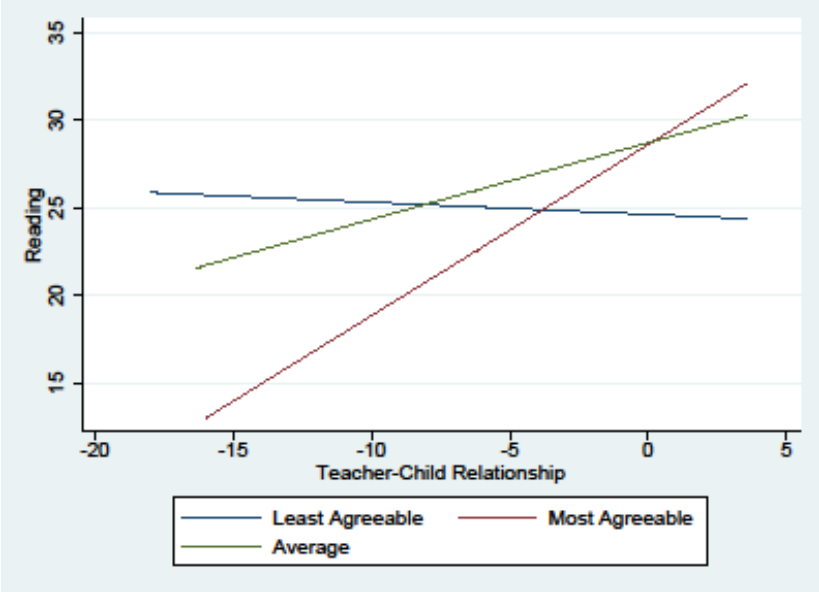
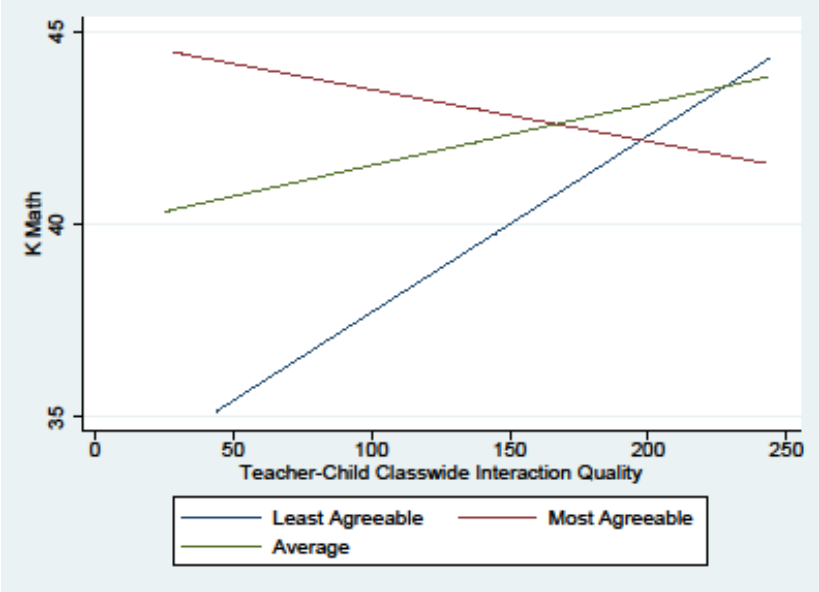


Figure 10. ECLS-B Moderation of the Association Between Teacher–Child Classwide Interaction Quality and Kindergarten Math Skills by Child's Temperament



In the FACES data, child temperament moderated the associations between teacher–child relationships and both kindergarten prosocial behavior and problematic behavior (see Figure 11 and 12). Both graphs indicate that teacher–child relationships were particularly salient for children with the least agreeable temperaments, or those children who were most active and least sociable during the direct assessments. Children's temperament moderated the association between teacher–child relationships and children's prosocial behavior such that more positive relationships were related to more prosocial behavior only for children with the least agreeable temperaments. Similarly, children's temperament moderated the association between teacher–child relationships and children's problem behavior such that more positive relationships were associated with less problem behavior only for children with the least agreeable temperaments. It appears that positive prekindergarten teacher–child relationships served as a buffer for children with less agreeable temperaments, and that those children with less agreeable temperaments who had the most positive relationships with their prekindergarten teachers closely resembled their peers with more agreeable temperaments in kindergarten.

Figure 11. FACES 2006 Moderation of the Association Between Teacher–Child Relationships and Kindergarten Prosocial Behavior by Children's Temperament

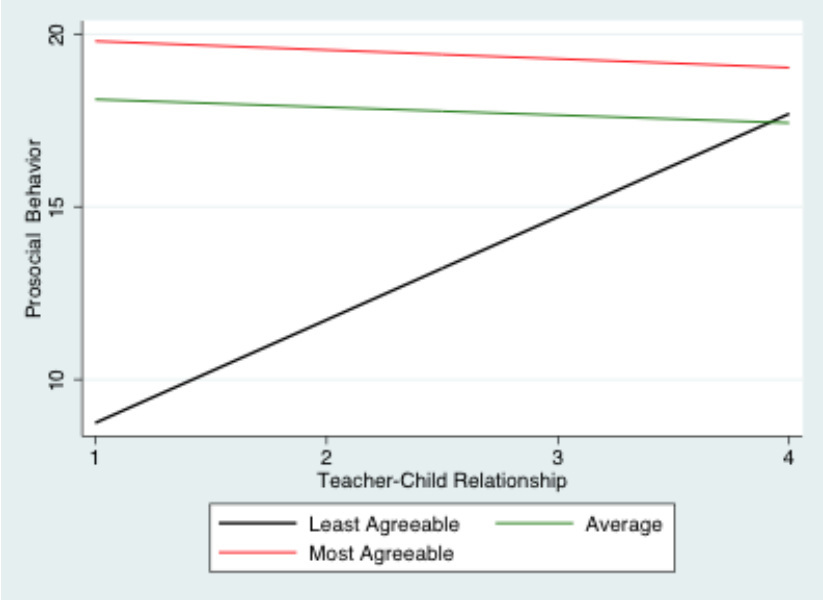
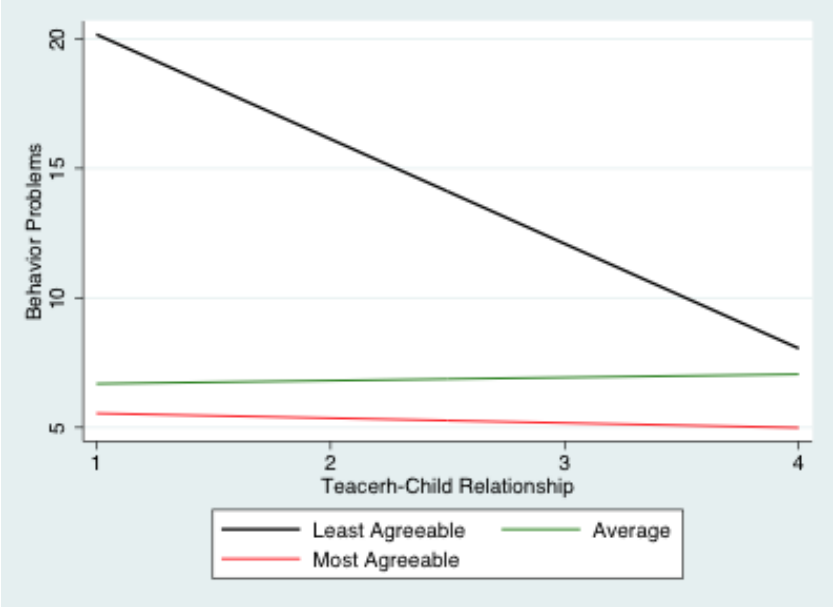


Figure 12. FACES 2006 Moderation of the Association Between Teacher–Child Relationships and Kindergarten Problem Behavior by Children's Temperament



Exploratory Analyses

Another acceptable, though less common, approach to moderation analyses in SEM is to divide the sample into groups by the moderating variable and compare model parameters across groups (Raykov & Marcoulides, 2006). This was not a part of the original analysis plan, but was conducted with both the HSIS data and the ECLS-B data (separately) to further examine possible influences of classwide interaction quality on the associations between teacher–child relationships and children's outcomes. In order to conduct these multigroup analyses, the sample was divided into three groups using STATA's quartile function. Each group is analyzed resulting in separate regression coefficients and standard errors for each group. These results can then be compared using a test for non-linear combinations of estimators (nlcom). The resulting significance test does not speak to the significance of the association between any given independent variable and dependent variable, but rather indicates whether that association is significantly different in one group as compared to another.

In the HSIS data, when groups were divided by quality of classwide interactions were analyzed, there were occasions where the association between teacher–child relationship and children's outcomes were statistically significant in some groups, but not in others. However, those associations were not significantly different from each other when the groups were statistically compared to one another. This would suggest that caution must be used in interpreting results related to teacher–child relationships and children's outcomes, as constraints in the variation of classwide interaction quality could lead researchers to draw different conclusions.

The ECLS-B dataset provides several indications that classwide interaction quality might moderate how these models work overall. Given that this dataset was designed to represent a birth cohort, as opposed to representing strictly a Head Start eligible sample, this sample is the most diverse. In this dataset the associations between teacher–child relationships and children's prosocial classroom behaviors are significantly different at various levels of teacher–child classwide interactions (see Figure 13). It appears that, in the case of prekindergarten relationships and children's prekindergarten positive behavior, the impact of classwide interaction quality is most important in less positive teacher–child relationships. There is a marginal difference in the associations between teacher–child relationships and children's prekindergarten reading scores when comparing the highest and lowest quality classrooms (Figure 14).

Figure 13. ECLS-B Multigroup Analysis of the Association Between Teacher–Child Relationships and Prekindergarten Prosocial Behavior

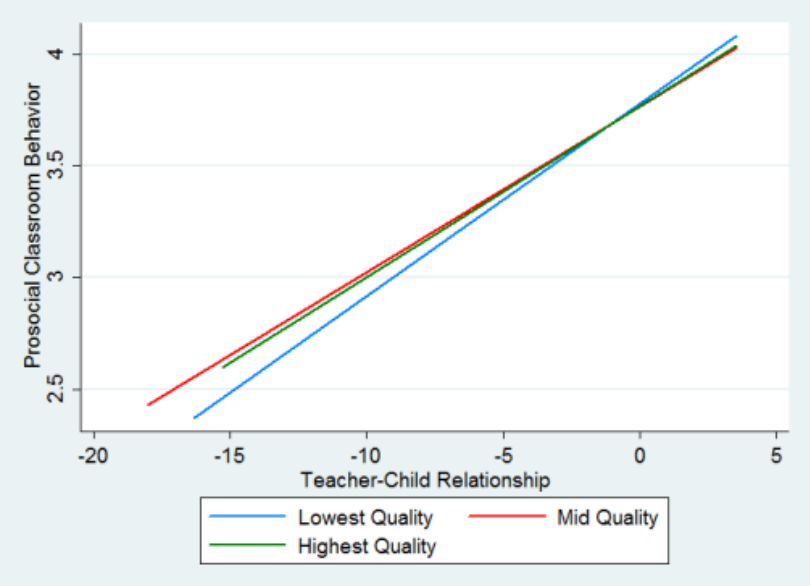
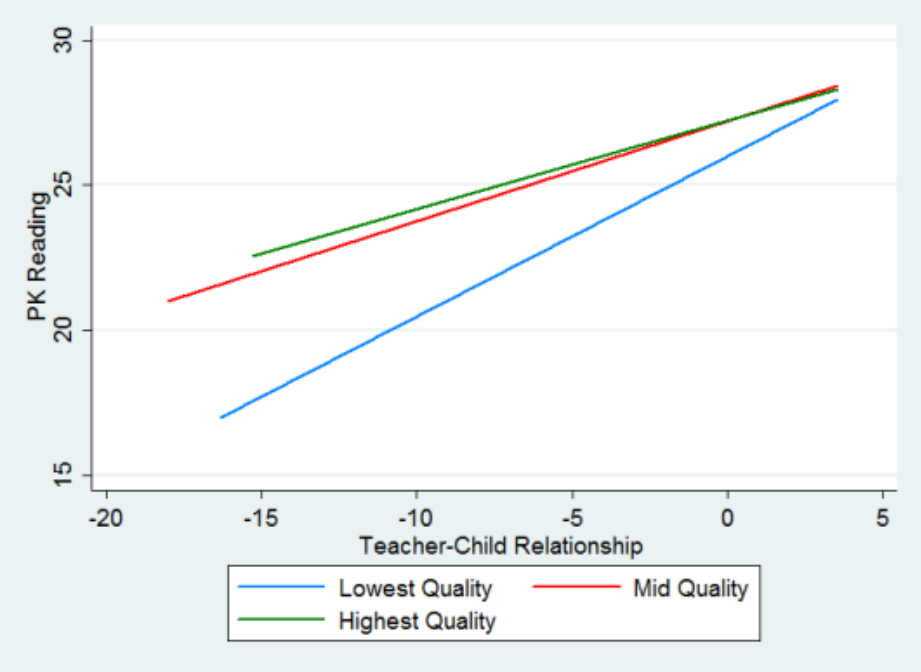


Figure 14. ECLS-B Multigroup Analysis of the Association Between Teacher–Child Relationships and Prekindergarten Reading



These differences become more distinct in reviewing the graphs related to children's kindergarten classroom behaviors. In regard to prosocial behavior, teacher–child relationships were most meaningful for students in low quality classrooms and least meaningful for students in the highest quality classrooms (Figure 15). Similarly, in regard to kindergarten problematic behavior, relationships with prekindergarten teachers were most meaningful for children in the lowest and mid quality classrooms, and least meaning for children in the highest quality classrooms (Figure 16). This is similar to the trend-level finding regarding teacher–child relationships and children's prekindergarten reading scores. Note here that the association only significantly differs between the highest and lowest quality classrooms, but not the mid quality classroom, and the

association between relationships and reading scores is only significant in the highest and lowest quality groups, but not the mid quality group. These exploratory findings are not further interpreted, but do suggest that future research using more refined measures of relationships and interactions are necessary.

Figure 15. ECLS-B Multigroup Analysis of the Association Between Teacher–Child Relationships and Kindergarten Prosocial Behavior

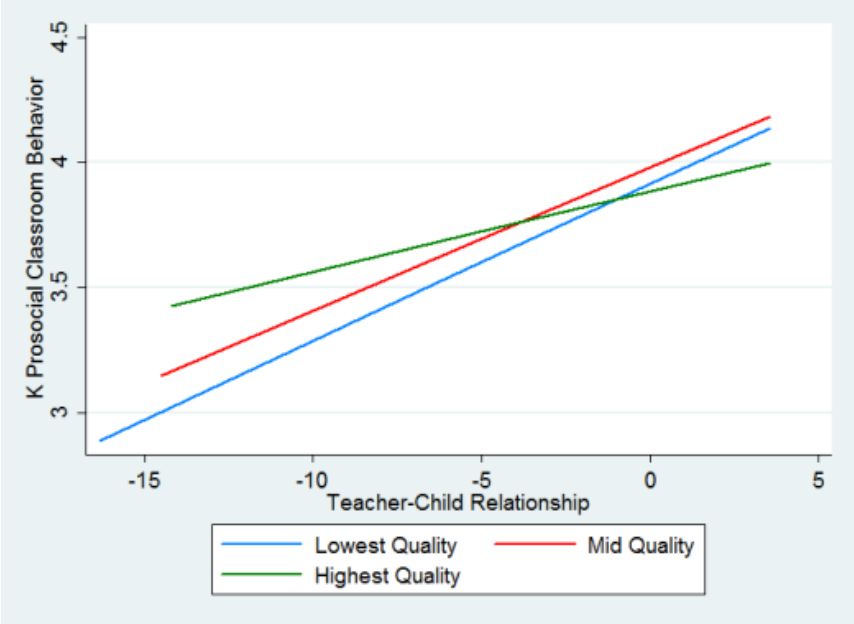
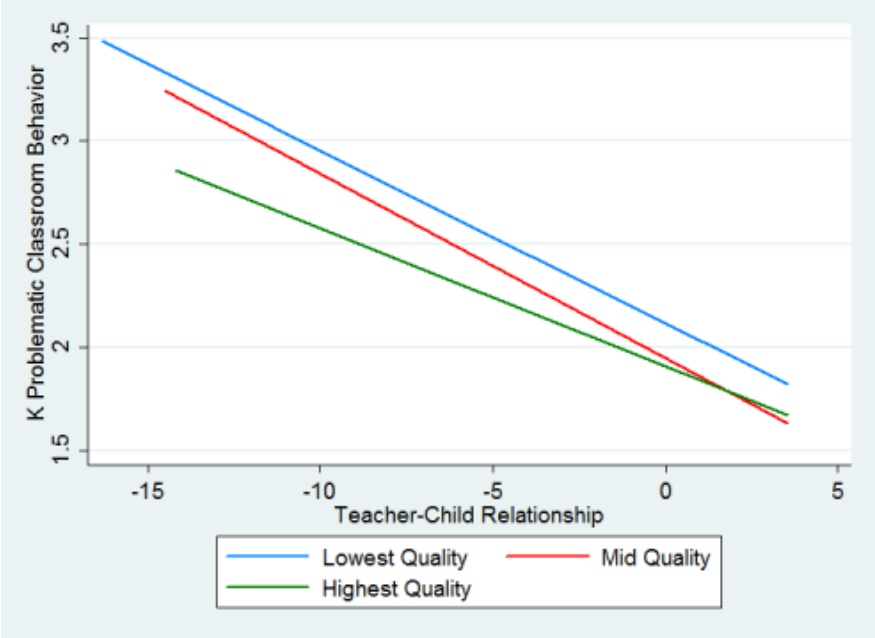


Figure 16. ECLS-B Multigroup Analysis of the Association Between Teacher–Child Relationships and Kindergarten Problem Behavior



CHAPTER VI

DISCUSSION

The aim of this study was to address questions concerning teacher–child interpersonal dynamics. Specifically, the primary goal was to examine empirical evidence suggesting that teacher–child relationships and teacher–child interactions are separate, but related concepts. The hypotheses were that confirmatory factor analysis would indicate two separate concepts and that these concepts would be moderately correlated. Findings suggest that teacher–child relationships and teacher–child interactions are distinct aspects of teacher–child interpersonal dynamics; however, they were not significantly correlated in any dataset. That teacher–child relationships and teacher–child interactions are statistically unrelated is surprising, but aligns with Jeon et al.'s (2010) findings that teacher–child relationships were associated with their observations of children's individual experiences of quality in the classroom, including both interaction quality and other aspects of quality measured by the ECERS-R, but were not related to ratings of similarly measured classwide quality.

Secondary aims of the current study were to examine the unique associations between each of the two interpersonal dynamics and children's outcomes and to examine two possible statistical moderations—teacher–child classwide interactions moderating the association between teacher–child relationships and children's outcomes, and children's temperament moderating the associations between teacher–child interpersonal dynamics

and children's outcomes. It was hypothesized that both teacher–child classwide interactions and teacher–child relationships would be significantly related to both children's academic and behavioral outcomes. Overall, teacher–child relationships were more consistently related to children's outcomes than teacher–child interactions. The main effect for teacher–child interactions is only significant in one case. There is support in all datasets that teacher–child relationships are related to behavioral outcomes, and support in the ECLS-B data that relationships are associated with academic outcomes. The hypothesis that interactions are directly associated with children's outcomes is not supported in the current study. However, there are some indications that the quality of classwide interactions in the classroom in which relationships occur make a difference in what those relationships mean for children's outcomes. Finally, there is some support for the hypothesis that children's temperament moderates the association between teacher–child interpersonal dynamics and children's outcomes. Each research question is discussed in detail below, drawing conclusions from across the three datasets.

RQ 1: Is there support for distinguishing teacher–child classwide interactions and teacher–child dyadic relationships as separate interpersonal dynamics?

Though the distinction between teacher–child interactions and relationships may seem somewhat intuitive, there is reason to question the assumption that either piece of data independently provides an adequate picture of children's classroom experience. In other words, it seems plausible that, in a given sample, children in classrooms with the highest interaction quality also have the most positive relationships with teachers and children in classrooms with the lowest interaction quality have the least positive

relationships with teachers. However, results from the current study suggest that children in these three samples, experienced varied relationships with their teachers regardless of the level of quality of the teacher-child interactions. From the examination of these three data sets, several indications exist that suggest that interactions and relationships are distinct concepts that provide distinct information for understanding children's experiences in classrooms. If measuring interactions and relationships provided the same information, then the children in the highest interaction quality classrooms would also be the children with the most positive relationships and all of the children would populate the cells on the diagonal. However, in each dataset some of the children in the highest quality classrooms are experiencing the least positive relationships and some of the children in the lowest quality classrooms are experiencing the most positive relationships of the children in the sample.

The second set of indicators that suggest that these dynamics should be considered separately comes from the confirmatory factor analyses. In all three dataset a single factor model of relationship and interaction variables was unacceptable, with poor model fit in the HSIS, failure to converge in the ECLS-B, and strong support for two factors in the FACES data. Indeed, none of the datasets indicated a significant correlation between teacher–child relationships and teacher–child interactions. Taken together, these findings in the current study suggest collecting data on both classwide interactions and dyadic relationships is advisable when research questions pertain to individual children's experiences of classroom interpersonal dynamics, similar to the

previously discussed conclusions needing both classwide and individual data to understand individual children's experiences in a classroom (Jeon et al., 2010).

RQ 2: How do teacher–child classwide interactions and teacher–child dyadic relationships uniquely contribute to children's academic outcomes and classroom behaviors when accounting for both dynamics?

Perhaps the more complex questions regarding interactions and relationships is whether they are both important for understanding children's learning and development. Over the last decade, a growing body of teacher professional development research would indicate that classwide interaction quality is significantly associated with children's academic and behavioral outcomes (Burchinal et al., 2008; Burchinal et al., 2010; Curby et al, 2009; Mashburn et al, 2008; NICHD, 2002; Phillips, McCartney, & Scarr, 1987); however, in the current study, teacher–child classwide interactions were only found to be significantly associated with one outcome—prekindergarten problem behavior—in one dataset—ECLS-B. Though we must be cautious in interpreting this single finding, the fact that it is related to problematic behavior, as opposed to an academic outcome, supports an initial concern with the affective emphasis of the classwide interaction measures. Recent re-analysis of the Caregiver Interaction Scale using the ECLS-B data underscores this concern in that interaction total scores were found to be unrelated to children's academic and behavior outcomes (Colwell, Gordon, Fujimoto, Kaestner, & Korenman, 2013). That this study found no association between the CIS and children's classroom behavior but the current study did find one significant

association may be a reflection of weighting the CIS subscales and including information from the ECERS-R as well in the measurement of interactions.

It is important to consider what is being measured in regard to interaction quality and how the measures in the current study differ from those in the cited literature. The two primary measures of classwide interaction quality in these datasets are the Caregiver Interaction Scale and then specific subscale factors created from the ECERS-R. The ECERS-R has long been considered an indicator of overall classroom quality (Perlman, Zellman, & Le, 2004), and there have been repeated efforts to pull a more narrowly focused factor out of measure that serves as an indicator of process quality or even teacher–child interactions specifically (Cassidy et al., 2005; Howes et al., 2011; Perlman et al., 2004). The Caregiver Interaction Scale is focused on social and emotional aspects of teacher–child interactions (e.g. "Seems to enjoy the children." "Finds fault easily with children."). The difference between these measures and those used in much of the more recent literature is that recent work using measures like the CLASS are narrowly focused on teacher–child interactions, and broadly focused on emotional, instruction, and classroom management aspects of teacher–child interactions. It is a great benefit to the field that national studies, like the FACES studies, continue to initiate new waves of data collection and to incorporate new measures. The soon-to-be available FACES 2009 collected scaled-down versions of the older measures and the full version of the CLASS in all three domains, will open up opportunities to examine how these differences in measures and different aspects of teacher-child interactions might be influencing the

findings regarding associations between classwide interact quality and children's outcomes.

The findings in the current study do support the hypothesis that teacher–child relationships are significantly associated with children's outcomes. Repeatedly teacher–child relationships are significantly related to children's classroom behaviors, and are also related to academic outcomes in the ECLS-B dataset. That findings in the ECLS-B would differ from the other two datasets is not surprising. Both the HSIS and FACES datasets are samples restricted to those children qualified for Head Start enrollment, which constricts the variation in income, among other variables. The ECLS-B is a birth cohort study and as such is nationally representative of children born in the U.S. in 2001. According to the bioecological model this is somewhat to be expected, as Proposition II in Bronfenbrenner's 2000 (pg.130) paper states, "the power of the *Process* varies systematically as a function of the environmental *Context* and of the characteristics of the *Person."* Thus, children in a birth cohort sample will have had wider variation in the contextual and experiential variables coming into the classroom than children in a restricted sample, and that in turn may cause variation in how the process (teacher–child relationships) is related to the children's outcomes.

When considering results across datasets, it is particularly interesting to note that in the ECLS-B the relationship variable is significantly associated with both children's math and reading scores in prekindergarten, though it is only marginally related to reading in the HSIS. The teacher–child relationship variable in both the HSIS and ECLS-B is drawn from short versions of the Student-Teacher Rating Scale for teacher–

child relationship, though the HSIS included 16 items and the ECLS-B only 5. As discussed above, one explanation for this difference in associations between teacher–child relationships and academic outcomes may be due to the greater variation in the sample. Another explanation of this may be that the ECLS-B assessments of reading and math were more holistic. For both the HSIS and FACES data, the current study relies on a single narrowly focused subscale from the Woodcock-Johnson III for reading and a single subscale for math. The ECLS-B used a reading assessment that had letter recognition and sounds items, word recognition items, and knowledge of print convention items. The ECLS-B math assessment included items for number sense, geometry, counting, patterns, and operations. (Najarian et al., 2010). In the FACES dataset, where the child's mother reported on the teacher–child relationship, relationships were not significantly association with academic outcomes.

In general, more significant findings were associated with children's behavior outcomes than academic outcomes, and this may be reflective of the affective emphasis of the teacher–child relationship and teacher–child interaction measures. Downer, Sobal, and Hamre (2010) propose a theory of within- and cross-domain associations between teacher–child interactions and children's outcomes. They specifically use the CLASS framework and suggest that direct effects are to be expected from classroom emotional support to children's social and emotional outcomes, from classroom organization to children's self-regulation, and from classroom instructional support to children's academic/cognitive outcomes. They identify a long history of these types of within-domain findings, but suggest a more complex process across domains. Given that

relationships are primarily affective in nature, it fits that the within domain social and emotional outcomes are most often related to teacher–child relationships. What remains lacking is a measure of teacher–child relationships tapping into organization and instructional aspects of the relationship. Downer et al.'s model would suggest that querying aspects of teacher–child relationships related to instruction would be more likely to return results related to children's academic outcomes. Asking teachers to rate items such as, "It is easy for me to gauge this child's understanding of a concept." or "This child hesitates to ask me questions." might provide information relevant to instructional aspects of the teacher–child relationship in much the same way that teachers currently report on closeness or conflict by responding to items such as, "It's easy to be in tune with this child." or "This child and I often struggle."

In both datasets where teacher–child relationships are reported by the teachers, more positive teacher–child relationships are significantly associated with more positive classroom behavior and less problematic classroom behavior. In the HSIS the association between more negative relationships and more disruptive problematic behavior remains significant through kindergarten, and associations between teacher–child relationships and both children's prosocial and problematic classroom behavior remain significant through the kindergarten year in the ECLS-B. In other words, prekindergarten teachers' reports of their relationship with children are significantly associated with kindergarten teachers' reports of the same child's classroom behavior a year later. Similarly, Hamre and Pianta (2001) have found associations between children's relationship with the prekindergarten teacher and school behavior through the end of elementary school, with

those students who had more negative prekindergarten teacher–child relationships rated as having less positive work habits and more disciplinary problems. Silver and colleagues not only found kindergartens with more conflictual teacher–child relationships to have more externalizing behaviors in the classroom, but also found conflict in this early teacher–child relationship to be associated with a trajectory of increasingly problematic behavior through third grade (Silver, Measelle, Armstrong, & Essex, 2005).

There are a few possible explanations for these associations with classroom behavior. As discussed above, this may be a function of within domain effects. It may also be that early relationship-building between teachers and children in the first few months of school sets up patterns of expectations for children much like early bonding and caregiving behaviors of parents help set patterns for attachment in children's first few years of life (Ainsworth, 1979; Pianta, Nimetz, & Bennet, 1997). Children with positive teacher–child relationships feel safe and secure. Children with negative relationships may display problematic or disruptive behaviors as a result of feeling insecure or uncomfortable in the classroom or as bids for attention. It must be acknowledged that prekindergarten teachers reported on both behavior and relationship in the HSIS and ECLS-B dataset or in the current study, so there is potential for mono-method bias (Shaddish, Cook, & Campbell, 2002). In other words, teachers who seem to build positive relationships with children (or see their relationships as positive) may also frame classroom behavior in less problematic ways or may be more effective at reducing problematic behavior and encouraging positive classroom behavior. The lack of association between mothers' report of the teacher–child relationship and children's

classroom behaviors in the FACES might give cause for this concern. However, that the association between prekindergarten teacher–child relationships and kindergarten teacher's reports of problematic behavior is significant in the ECLS-B and HSIS, and that the FACES, with mothers reporting on teacher–child relationships, is also significant would lend support to the notion that early relationships have implications for children's classroom behavior.

The robustness of the link between teacher–child relationships and classroom behaviors leads to further questions. Specifically, which came first? This is difficult to interpret, and impossible to ascertain from the data in the current study. Though children's temperament has been controlled for in each model, in an attempt to understand to some extent the disposition the child enters school with, the role that children's temperament and other child characteristics play in the development of positive relationships remains unclear. As discussed above, it is possible that early negative teacher–child relationships set children on a trajectory for problematic relationships and behavior in school, though some research indicates a tendency toward decreased conflict in the relationship as children age (Pianta & Stuhlman, 2004). On the other hand, it is possible that children who demonstrate challenging behaviors from the very beginning are challenging for teachers to build positive relationships with. Birch and Ladd's (1998) study of 199 kindergarteners would support both/either of the above possibilities. Kindergarten teachers were asked to report on both children's challenging behavior and their teacher–child relationships. Birch and Ladd found kindergarten antisocial behaviors to predict more conflict and less closeness in first grade teacher–

child relationships, suggesting challenging behavior makes it establishing positive relationships difficult.

Similarly, Howes, Phillipsen, & Peisner-Feinberg (2000) found that earlier teacher–child relationships and earlier classroom behavior predicted both later teacher–child relationships and later classroom behavior. In this study, Howes et al. followed approximately 350 children through two years of prekindergarten and a year of kindergarten, and 475 children through one year of prekindergarten and one year of kindergarten. In each year teachers reported on closeness and conflict in teacher–child relationship and on children's positive and problem classroom behavior. Prekindergarten teacher reports of problem behavior predicted conflict in the kindergarten teacher–child relationship and kindergarten problem behavior; prekindergarten teacher reports of conflict in the prekindergarten teacher–child relationship predicted kindergarten problem behavior and conflict in the kindergarten teacher–child relationship, and similar paths of influence were true of closeness in teacher–child relationships and children's positive classroom behaviors. It should be noted that child care quality, assessed as a composite of the ECERS, CIS, Adult Involvement Scale, and Child-care Quality Index, in prekindergarten was associated with closeness in the kindergarten teacher–child relationship. Likely, both of the preceding statements regarding the possible directions of influence of problem behaviors and conflict in relationships are true, are at work simultaneously, and may differ for different teachers and children. The take home point here, however, is that teachers may need extra support in building relationships with

challenging children and challenging children may need extra support in relationship-building efforts.

RQ.3 Do teacher–child interactions moderate the association between teacher–child relationships and children's outcomes?

There is surprisingly little support across the datasets for the idea of statistical interaction effects between relationships and interactions. Indeed, it does not appear from the product term models that teacher–child classwide interactions are moderating the associations between teacher–child relationships and children's outcomes. Statistically speaking, these models also indicate that teacher–child relationships do not moderate the association between teacher–child interactions and children's outcomes. Additionally, groupwide interaction quality does not predict relationships in any dataset; in fact, they are not even significantly correlated. There is significant between-class variation in the FACES dataset; however, that between-class variation is not significantly explained by teacher–child classwide interactions. Perhaps the clearest message from these analyses is that classrooms are very complex, and understanding how teacher–child interpersonal dynamics are working in a given classroom is a complicated matter.

An unfortunate constraint of the data must be noted here. In both datasets with teacher report of the teacher–child relationship, only one child from each classroom is included. This ties together the relationship and interaction scores in a way that could be parsed out if teacher report of her relationship with multiple children in the same classwide interaction context was available. However, data with multiple children in the

same classroom is only available in the FACES data where mothers reported about their child's teacher–child relationship.

As noted above in the exploratory analyses, another acceptable way to examine moderation in structural equation modeling is to create subpopulations based on variation in a particular variable and conduct multigroup analyses. This is often used to compare models across different ethnicities, languages, or genders (Kline, 2011). This technique operates on the proposition that differences in the moderating variable have the potential to not only impact the association between one other independent variable and the dependent variables, but rather that differences in the moderating variable might impact how all aspects of the model are operating (Kline, 2011). So, in the current study, the proposition is that in the lowest quality classrooms, teacher–child relationships, adult–child ratios, children's temperaments, and all of the control variables may associate with children's outcomes differently than they do in high–quality classrooms. Given the focus of the current study, only differences in the teacher–child relationship and child outcome association between groups were tested for significance, and these exploratory analyses were only conducted in the ECLS-B data. There was some indication from this approach that teacher–child relationships are more or less significant in different classwide interaction quality contexts, and that there is more variation in children's outcome across classwide interaction quality levels when children have less positive teacher–child relationships.

RQ4. Does children's temperament moderate the associations?

It is crucial to remember, from a bioecological approach, that characteristics of individuals in the relationship are important. In all three datasets temperament is directly associated with children's outcomes. This is neither new nor surprising given similar findings in previous work (Coplan et al., 1999; Martin & Holbrook, 1985; Newman et al., 1998; Rimm-Kaufman & Kagan, 2005). The primary interest regarding temperament in this study is how children's temperament may interact with teacher–child interpersonal dynamics. In four instances, child's temperament significantly moderated the association between an interpersonal dynamic and a child outcome. In three of the four cases, it appears that children with the least agreeable temperaments were most sensitive to the teacher–child interpersonal dynamic. In relation to children's kindergarten math scores in the ECLS-B data, Figure 10 indicates that in classrooms with the lowest classwide interaction quality, children with the least agreeable temperaments were scoring the lowest on math achievement, yet in classrooms with the highest classwide interaction quality, children with the least agreeable temperaments were scoring the highest on math achievement. This finding resembles Belsky's (Pleuss & Belsky, 2009) model of differential susceptibility, which suggests that some children will be more sensitive to a given stimulus than others, and thus those children will have the least positive outcomes in lower quality/negative relationships and the most positive outcomes in high quality/positive relationships. Similarly, in the FACES data, teacher–child relationships appear unrelated to children's classroom behavior for children in the average and most

agreeable temperament groups, but children with the least agreeable temperaments appear to benefit from more positive teacher–child relationships.

In must be acknowledged that temperament was measured in the current study by an assessor rating the child's sociability, focus, and engagement during the fall prekindergarten direct assessment. Children who displayed more negative affect, were less engaged, were more easily distracted, and who were less sociable are the children making up the "least agreeable" group. These children appear to benefit in the same way that the children in Silver et al.'s (2005) who displayed aggressive behaviors in prekindergarten benefited the most from close teacher–child relationships. In this sample, children who displayed average amounts of prekindergarten aggressiveness showed a deceleration in externalizing behavior through third grade when they had close kindergarten teacher–child relationships. This deceleration was even greater for children who had prekindergarten aggressive behaviors +1 SD from the average who had close kindergarten teacher–child relationships.

Though findings regarding the moderating effect of temperament were somewhat limited in the current study, they do suggest that research in this area is worthy of continued pursuit, and the works of others' suggest the same. Recent work by Vitiello and colleagues (2012) involving 179 prekindergarteners used the CLASS to assess classwide interaction quality. Teachers in the study were asked to classify children's temperament as overcontrolled, undercontrolled, or resilient. They found significant moderating effects of children's temperament on the association between ratings on the CLASS instructional support domain and children's gains in pre-reading and math such

that children who were classified as having overcontrolled temperaments and in classroom with high instructional support had larger increase in reading and math scores than children classified as resilient. Interestingly, temperament moderated the association between emotional support and children's reading scores such that these same overcontrolled children in emotionally supportive environments had lesser gains in reading than their resilient counterparts. Given that instructional support was more meaningfully connected to academic outcomes for overcontrolled children, but emotional support was more salient for resilient children, that there is room for additional research to tease apart the complex connections among children's temperament and various teacher–child interpersonal dynamics.

That children's temperament and teacher–child interpersonal dynamics are related is somewhat evident. Rudasill and Rimm-Kaufman (2009) illustrate an aspect of the complexity of these associations by looking at children' temperament, teacher–child relationships, and teacher–child dyadic interactions slightly differently from other studies. They found a main effect of an aspect of children's temperament, shyness, on both closeness and conflict in the teacher–child relationship, such that children who were shyer had teacher–child relationships rated as both less conflictual and less close. Additionally, the frequency of child-initiated teacher–child dyadic interactions mediated the association between children's shyness and closeness in their teacher–child interactions. While the Rudasill and Rimm-Kaufman study raises a number of new research questions, it also suggests that observations of children's individual interactions

may add information about how children's temperament and various teacher–child interpersonal dynamics are related to children's outcomes.

The temperament moderation analyses were aimed at examining how teacher–child interpersonal dynamics might matter in different ways for children with varying temperaments. Teachers also bring experiences, personalities, and other characteristics into the classroom. Teachers' educational backgrounds, experience, and attitudes about classroom practice are known to predict classwide interaction quality (Mashburn, Hamre, Downer, & Pianta, 2006; Pianta et al., 2005). Teachers who report more depressive symptoms and stress have been shown to provide less sensitive and more negative interactions than those caregivers who reported fewer depressive symptoms (Hamre & Pianta, 2004; Yoon, 2002). However, teacher characteristics were not believed to moderate either the association between classwide interactions and children's outcomes or teacher–child relationships and children's outcomes. It is more likely that teacher characteristics predict teacher–child relationships and classwide interaction quality, and analyses of this type were beyond the scope of, and outside the research questions of, the current study.

Summary of Findings

Overall, in regard to the bioecological model, the results of this study provide mixed support. The significant findings related to teacher–child relationships and children's behavior outcomes support the idea that teacher–child relationships are an important proximal process that children experience in the early childhood classroom. The theory would also suggest that the proximal processes of interest must be

meaningfully related to the outcome of interest. Whereas there are a few indications of significant associations between children's academic outcomes and teacher–child interpersonal dynamics, as measured in the current study with a social and emotional focus, further support for the importance of teacher–child relationships and interactions specifically for academic development may come from more refined measures of interpersonal dynamics that target or are focused on learning experiences and instructional aspects of the classroom.

Though support for the importance of the proximal process of teacher–child relationships is clear, support for the notion that teacher–child classwide interactions provide an important context in which that proximal process occurs is less clear. Only one significant direct effect of teacher–child interactions was identified. However, through exploratory analyses in the ECLS-B dataset, there are indications that the statistical models operate differently in the different qualities of classwide interactions (i.e. the context part of the PPCT model) and that one of those differences is how teacher–child relationships are related to children's outcomes. This would align with Bronfenbrenner's Process-Person-Context-Time conceptualization of the bioecological model, as the process would have different meaning in different context.

Both Person and Time aspects of the theory are complex in the current study. There was a great deal of support for the idea that the person characteristic of temperament was related to children's outcomes, but limited support for the theoretical idea that this characteristic would interact with the proximal process in a significant way. Time was not a central aspect of these analyses, but did illuminate the enduring link

between teacher–child relationships in prekindergarten and children's problematic behavior in kindergarten. These analyses were conducted without accounting for any aspects of the kindergarten classroom or kindergarten teacher–child relationship, and it is difficult to determine to what extent teacher–child interpersonal dynamics in the kindergarten year impacted these results. In is not possible in the current study to discern to what extent the associations that were significant in the prekindergarten year, but not the kindergarten year (such as teacher–child relationships and children's academic outcomes in the ECLS-B) where influenced by kindergarten teacher–child interpersonal dynamics, time, or measurement.

Limitations

Measurement is a limitation throughout this study. The use of three datasets was an attempt to address measurement issues by pulling from the strengths of each dataset to compensate for the weaknesses in the others. The HSIS data was chosen as the initial dataset for analysis and all later analyses were to attempt to replicate these as closely as possible. The largest concerns are with measurement of both interactions and relationships. In all but the FACES data, classwide interaction quality is narrowly focused on emotional aspects of interactions, and interaction quality ratings do not reflect any indication of the interaction quality around instruction support. Studies employing measures with emphasis on aspects of interactions and relationships more directly related to instruction and learning, or a combination of learning focused and affective focused, may find more associations of these teacher–child dynamics with children's academic outcomes.

An additional limitation, stemming from the scope of the study, is the lack of teacher information included in the models. This decision was made based on the emphasis in the study to examine measurement related to teacher–child interpersonal dynamics not predictors of those dynamics. However, in terms of theory and bigger picture understanding, it would be important in the future to consider characteristics of teachers. Ethnic/racial match between teachers and children was added to HSIS models as a post hoc analysis, but did not change the models and was not significantly associated with children's outcomes. Though Saft and Pianta (2001) found ethnicity match between teachers and children to predict teachers reporting a closer teacher–child relationship, Ewing and Taylor's findings similar to the current study did not show a moderating effect of ethnic match on associations between teacher–child relationships and children's outcomes (2009; see also Hamre & Pianta, 2001). Beyond demographic characteristics, other characteristics of teachers, such as their beliefs related to developmentally appropriate practice, their goals for and expectations of young children, and their own perceptions of what it means to be a good teacher should be considered. Relationships teachers have with children in their classrooms and their ratings of these relationships may be influenced by these types of characteristics, as well as their interactions and their general perceptions of children in the classroom.

Similar to the limitation identified above in regard to teachers, only one child characteristic was considered. Extant research has identified a number of child characteristics that predict teacher–child relationship quality, including temperament (Rudasill, Rimm-Kaufman, Justice, & Pence, 2006), gender (Birch & Ladd, 1997; Hamre

& Pianta, 2001), earlier problem behavior (Baker, 2006), and language skills (Rudasill et al., 2006). In regard to the current study, it is particularly important to note that temperament here is narrowly considered in terms of how it might moderate the association between teacher–child interpersonal dynamics and children's outcomes, and not how it is contributing to teacher–child relationships or interactions. Just as with teachers, incorporating additional child characteristic could add to a fuller understanding of classroom interpersonal dynamics and young children's early classroom experiences, but are beyond the scope of the current study.

A few other limitations in the current study must be acknowledged. Temperament in the ECLS-B is measured with the Bayley Short Form, which has been used in the various ECLS studies, but differs from the temperament measure in the other two datasets. Additionally, reliability and validity data for the parent report of teacher–child relationships is unavailable for the FACES data. An additional concern related to measurement is the use of standardized test scores as indicators of academic achievement. Though this is standard practice in large scale studies, the use of these measures alone may fail to detect associations between teacher–child interpersonal dynamics and other important aspects of academic development, such as problem solving, perseverance, engagement, and other components of approaches to learning. Finally, the use of structural equation modeling presented challenges for moderation analyses, and across all of the analyses the influence of teacher and child characteristics were restricted. Analyses intended to incorporate characteristics or behaviors of both the

teacher and the child in an interdependent fashion, such as the Actor–Partner Interdependence Model (Cook & Kenny, 2005) may be a better approach.

Implications and Future Directions

Though several limitations in the current study have been acknowledged, the study adds several ideas to move research in the area of teacher–child interpersonal dynamics forward. First, there are indications that interactions and relationships are operating differently in early childhood classrooms. Second, teacher–child relationships may have different meaning for children's outcomes in different classwide interaction quality contexts. Third, and perhaps most important, there is a strong link between negative teacher–child relationships and children's problematic classroom behaviors. Implications for practice and future research are discussed below.

Practice. The current study re-emphasizes the importance of relationships in early childhood classrooms. Building relationships with young children takes certain skills and teacher development programs must be attentive to this. Preliminary work in teacher professional development regarding classroom relationship-building skills indicates positive potential. Intervention work by Helker and Ray (2009) showed increased use of relationship-building techniques by teachers and decreased externalizing behavior by targeted students for those classrooms when teachers participated in relationship training. In seeking to improve children's early care and education experiences, it is important to equip teachers to build positive relationships and to support their relationship-building efforts, particularly with challenging children.

The importance of relationships in early childhood classrooms has relevance to classroom policies and routines that can either support or challenge relationship building in the classroom. Given the importance of building relationships in classrooms, teachers and children need opportunities to do so. When teacher–child ratios are high, teachers have less time to spend with individual children. If the emphasis of their time is spent on meeting basic needs and monitoring then their time interacting with individual children, getting to know them and building a relationship with them, is limited. Prioritizing relationships would mean structuring classrooms and programs in a way that minimizes the number of relationships both teachers and children are trying to build, and maximizes the time to build them.

Future Research. Future research is needed to address remaining questions of both methodological and substantive natures. In particular, there is room for expanded measures of teacher–child relationships and development of measures to assess children's individual teacher–child interactions. In terms of relationship measures, the current study highlights two main challenges that remain to be addressed. First, this variable is skewed in each dataset used in the current study. This may be a reflection of too few questions being used to measure this variable in the ECLS-B and the HSIS; however, it maybe also reflect that teachers generally have similar relationships with children. Measures that tap into more nuanced differences in relationships, through both more questions and questions that query more detail, are needed. A further extension of measurement work with teacher–child relationships is to find ways to assess parts of the relationship less related to feelings and more related to instructional aspects of the relationship. For

example, teachers could report on their knowledge of a child's interests and abilities, their own ability to tune into a specific child's comprehension of concepts, and their understanding of a child's need for support in scaffolding or transitions. These types of teacher reports might provide a clearer picture of how the teacher and child work together. Future research should also seek to collect teachers' reports of their relationships with several children in the same classroom. This would provide a clearer look at how relationships vary within classroom, the extent to which teacher report on relationships may be related to characteristics of a specific teacher, and how different relationships within the same classroom matter for children's outcomes.

As mentioned before, one of the primary limitations of the current study is the inability to extricate the primary concepts from their measurement and level of measurement. Future research needs to consider how to incorporate additional information. It is challenging to think of how other people outside of the teacher–child relationship could report on that relationship; however, an observational measure of individual children's experiences of interactions in the classroom could be the missing link that would add valuable information to the extant teacher–child relationships and teacher–child classwide interaction measures. If observations of individual children's interaction experiences were collected over time, those observations would add additional information about the teacher–child. A more complete picture could be captured with measures of teacher–child relationships from multiple dyads in the classroom, an observation of general interaction quality in the classroom, and an observation of individual children's experiences.

Substantively, several interesting research questions remain to be explored. Certainly the current study raises questions about the enduring association between prekindergarten teacher–child relationships and children's problematic behaviors. It was discussed above that it is difficult to determine which comes first, as extant research seems to indicate that both negative relationships and problem behavior predict one another. The question remains as to whether the cycle of problematic behaviors and negative relationships can be broken. Indeed, Rudasill found children's relationships with their first grade teacher to mediate the associations between children's characteristics and their relationships with their third grade teachers, suggesting that, "child characteristics are connected to later teacher–child relationships in part through the quality of their relationships in first grade, with early relationship quality establishing patterns for later relationship quality" (2011, p.154). Research involving elementary age children indicates that while children with behavioral challenges are less likely to build positive relationships with teachers, those who manage to build positive teacher–child relationships often fare better than their peers with behavioral challenges and less positive relationships (Baker, 2006; Silver et al., 2005). In other words, where teachers are able to establish positive teacher–child relationships with children with behavior challenges, it is beneficial for these children. Future research exploring the mechanisms of how positive relationships are established even when children have difficult behavior (or other risk factors) is needed, as is research exploring possible mediating mechanisms in the link between negative relationships and problematic behavior.

Finally, future research should continue to explore how teacher–teacher relationships and teacher–child classwide interactions work together to promote children's learning and development. That relationships and interactions were not statistically related in any of the three datasets in the current study seems surprising and calls for researchers to carefully consider their research questions and the data needed to answer those questions. There was some indication in the exploratory analyses that teacher–child relationships are more or less significant in different classwide interaction quality contexts, and that there is more variation in children's outcome across classwide interaction quality levels when children have less positive teacher–child relationships. Future research should consider whether some child and teachers would benefit more from targeting relationships for intervention and others from targeting interactions for intervention.

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APPENDIX A

ADDITIONAL TABLES

Table 24. HSIS Confirmatory Factor Analysis One-factor Solution

SMRS= 0.28 CD= 0.99	Standardized coefficient (SE)	Unstandardized coefficient (SE)
STRS Close ->TCID	.32 (.04)*	1*
STRS Conflict -> TCID	-1.00 (.00)*	-5.16 (.67)*
CIS Detached -> TCID	-.01 (.03)	-0.02 (.04)
CIS Harsh -> TCID	.02 (.03)	.04 (.09)
CIS Independence -> TCID	-.02 (.05)*	-.03 (.08)
CIS Permissive -> TCID	.06 (.04)	.06 (.04)
CIS Sensitivity -> TCID	.07 (.03)*	.06 (.04)*
ECERS-R Materials & Activities -> TCID	.04 (.04)	.36 (.16)
ECERS-R Language & Interaction -> TCID	.07 (.04)t	.04 (.04)t
CIS Harsh*CIS Permissive	.72 (.04)*	2.01 (.35)*
ECERS-R M/A*ECERS-R L/I	.58 (.05)*	.83 (.13)*

Table 25. HSIS Confirmatory Factor Analysis Three-factor Solution

SMRS= .03 CD= 1.00	Standardized coefficient (SE)	Unstandardized coefficient (SE)
STRS Close -> Relationship	.32 (.04)*	1
STRS Conflict -> Relationship	-1.00 (.00)*	-5.16 (.67)*
CIS Detached -> CIS	.55 (.06)*	1
CIS Harsh -> CIS	.68 (.04)*	2.07 (.27)*
CIS Independence -> CIS	.58 (.04)*	1.47 (.21)*
CIS Permissive -> CIS	.69 (.04)*	.97 (.15)*
CIS Sensitivity -> CIS	.89 (.02)*	6.48 (.77)*
ECERS-R Materials & Activities -> ECERSR	.64 (.05)*	1
ECERS-R Language & Interaction -> ECERSR	.91 (.03)*	1.40 (.12)*
CIS Harsh*CIS Permissive	.47 (.07)*	.71 (.17)*
CIS*ECERSR	.88 (.03)*	.55 (.13)*
Relationship*CIS	.01 (.03)	.01 (.03)

Table 26. ECLS-B Confirmatory Factor Analysis Original Two-factor Solution

SMRS= 0.07 CD= .98	Standardized coefficient (SE)	Unstandardized coefficient (SE)
STRS comfort -> Relationship	.22 (.06)	1
STRS struggle -> Relationship	-.57 (.05)	-2.06 (.44)***
STRS physical affection -> Relationship	-.31 (.08)	-1.08 (.23)***
STRS angry -> Relationship	-.62 (.05)	-2.79 (.79)***
STRS bad mood -> Relationship	-.71 (.04)	-3.17 (.77)***
STRS in tune -> Relationship	.15 (.07)	.67 (33)*
CIS Detached -> Interaction	.51 (.05)	1
CIS Harsh -> Interaction	.62 (.05)	2.47 (.28)***
CIS Permissive -> Interaction	.63 (.06)	1.02 (.11)***
CIS Sensitivity -> Interaction	.74 (.03)	4.88 (.51)***
ECERS-R Furnishings and Displays -> Interaction	.74 (.02)	.89 (.14)***
ECERS-R Personal Care -> Interaction	.63 (.03)	1.02 (.17)***
ECERS-R Language and Talking -> Interaction	.85 (.02)	1.25 (.16)***
ECERS-R Learning Activities -> Interaction	.77 (.03)	1.00 (.16)***
ECERS-R Interactions -> Interaction	.83 (.02)	1.24 (.14)***
ECERS-R Program Structure -> Interaction	.76 (.02)	1.28 (.17)***
CIS Harsh*CIS Permissive	.74 (.04)	2.64 (.48)***
Relationship*Interaction	-.04 (.05)	.00 (.01)

Table 27. ECLS-B Confirmatory Factor Analysis Three-factor Solution

SMRS= 0.07 CD= .98	Standardized coefficient (SE)	Unstandardized coefficient (SE)
STRS comfort -> Relationship	.22 (.06)	1
STRS struggle -> Relationship	-.57 (.05)	-2.06 (.44)***
STRS physical affection -> Relationship	-.31 (.08)	-1.08 (.23)***
STRS angry -> Relationship	-.62 (.05)	-2.79 (.79)***
STRS bad mood -> Relationship	-.71 (.04)	-3.17 (.77)***
STRS in tune -> Relationship	.15 (.07)	.67 (33)*
CIS Detached -> CIS	.64 (.04)	1
CIS Harsh -> CIS	.73 (.04)	2.32 (.24)
CIS Permissive -> CIS	.75 (.04)	.97 (.10)
CIS Sensitivity -> CIS	.91 (.03)	4.79 (.51)
ECERS-R FD -> ECERSR	.79 (.02)	1
ECERS-R PC -> ECERSR	.66 (.03)	1.11 (.07)
ECERS-R LT -> ECERSR	.84 (.02)	1.29 (.06)
ECERS-R LA -> ECERSR	.82 (.02)	1.12 (.04)
ECERS-R INT -> ECERSR	.78 (.02)	1.22 (.08)
ECERS-R PS -> ECERSR	.79 (.02)	1.39 (.05)
CIS Harsh*CIS Permissive	.65 (.05)	1.69*** (.38)
CIS*ECERSR	.72 (.04)	.78*** (.11)
Relationship*CIS	-.03 (.05)	.00 (.01)
Relationship*ECERSR	-.05 (.05)	.00 (.01)

Table 28. FACES 2006 Multilevel Model of Prekindergarten Reading

	Basic Model	Teacher–Child Relationship	Child Experience	Full Model
Intercept	97314*** (.68)	97.16*** (5.34)	91.60*** (7.09)	71.51*** (7.55)
Teacher–Child relationship		-.07 (1.39)	-.01 (1.39)	.83 (1.44)
Classroom				
Teacher–Child Classwide Interactions			.05 (.08)	-.02 (.09)
Classroom Adult–Child Ratio			.53 (.34)	.24 (.37)
Child Characteristics				
Gender				2.05 (1.27)
Age				-4.66*** (1.09)
Child non-Hispanic White				1.19 (2.43)
Child non-Hispanic Black				6.87* (3.14)
Child non-Hispanic Other				3.11 (2.64)
Child Temperament				.24*** (.04)
Identified Special Need				-5.88t (3.31)
Home Language				1.88 (1.88)
Family Income				.26 (.36)
Mother's Education				2.22** (.73)
Random Effects Components				
Identity (cons)	112.97 (10.03)	112.96 (10.04)	111.82 (10.04)	111.80 (9.82)
ID (Residual)	120.57 (7.95)	97.16 (5.34)	120.57 (7.95)	100.87 (7.10)
Log Likelihood	-524029.49	524029.48	-524028.23	-469483.52

t=p<.10, *=p<.05, **=p<.01, ***=p<.001

Table 29. FACES 2006 Multilevel Model of Prekindergarten Math

	Basic Model	Teacher–Child Relationship	Child Experience	Math
Intercept	88.14*** (.67)	90.73*** (4.50)	92.28*** (6.50)	70.54*** (6.60)
Teacher–Child Relationship		-.68 (1.19)	-.68 (1.19)	-.30 (1.14)
Classroom				
Teacher–Child Classwide Interactions			.03 (.09)	-.09 (.08)
Classroom Adult–Child Ratio			.41 (.32)	.11 (.33)
Child Characteristics				
Gender				.40 (1.22)
Age				-3.70*** (1.01)
Child non-Hispanic White				6.85** (2.25)
Child non-Hispanic Black				-.17 (2.38)
Child non-Hispanic Other				3.42t (1.89)
Child Temperament				.25*** (.04)
Identified Special Need				-12.91* (5.51)
Home Language				-2.82 (1.97)
Family Income				.57 (.38)
Mother's Education				2.54*** (.72)
Random Effects Components				
Identity (cons)	110.67 (13.64)	111.35 (13.78)	110.57 (13.81)	94.754 (13.74)
ID (Residual)	116.37 (9.12)	116.30 (9.11)	116.30 (9.11)	89.511 (6.93)
Log Likelihood	-521599.61	-521563.96	-521563.07	-461960.15

t=p<.10, *=p<.05, **=p<.01, ***=p<.001

Table 30. FACES 2006 Multilevel Model of Prekindergarten Prosocial Behavior

	Basic Model	Teacher–Child Relationship	Child's Experience	Full Model
Intercept	18.39*** (.22)	17.17*** (1.63)	14.69*** (2.17)	12.50*** (2.03)
Teacher–Child relationship		.32 (.42)	.32 (.43)	.34 (.38)
Classroom				
Teacher–Child Classwide Interactions			.04 (.03)	.03 (.03)
Classroom Adult–Child Ratio			.13 (.12)	.03 (.12)
Child Characteristics				
Gender				1.06*** (.29)
Age				.49t (.26)
Child non-Hispanic White				-.75 (.62)
Child non-Hispanic Black				-.61 (.60)
Child non-Hispanic Other				-.69 (.79)
Child Temperament				.06*** (.01)
Identified Special Need				-1.66t (.97)
Home Language				.06 (.53)
Family Income				-.23* (.11)
Mother's Education				.07 (.26)
Random Effects Components				
Identity (cons)	12.25 (1.01)	12.26 (1.02)	12.13 (1.00)	10.94 (.90)
ID (Residual)	7.64 (.80)	7.62 (.80)	7.62 (.80)	6.47 (.66)
Log Likelihood	-334861.54	-334739.3	-334737.98	-296722.55

t=p<.10, *=p<.05, **=p<.01, ***=p<.001

Table 31. FACES 2006 Multilevel Model of Prekindergarten Problematic Behavior

	Basic Model	Teacher–Child Relationship	Child's Experience	Full Model
Intercept	5.78*** (.33)	8.22*** (2.07)	11.39*** (3.09)	15.50*** (3.16)
Teacher–Child relationship		-.64 (.54)	-.64 (.54)	-.60 (.49)
Classroom				
Teacher–Child Classwide Interactions			-.03 (.04)	-.03 (.04)
Classroom Adult–Child Ratio			-.28t (.16)	-.09 (.16)
Child Characteristics				
Gender				-1.78*** (.37)
Age				-.53t (.31)
Child non-Hispanic White				2.62*** (.68)
Child non-Hispanic Black				1.40* (.57)
Child non-Hispanic Other				.60 (.80)
Child Temperament				-.11*** (.02)
Identified Special Need				2.89t (1.55)
Home Language				-.28 (.59)
Family Income				.16 (.12)
Mother's Education				.11 (.31)
Random Effects Components				
Identity (cons)	26.36 (3.22)	26.37 (3.20)		22.71 (2.82)
ID (Residual)	15.23 (1.80)	15.18 (1.79)		10.80 (1.13)
Log Likelihood	-382212.45	-381970		-328986.10

t=p<.10, *=p<.05, **=p<.01, ***=p<.001

Table 32. FACES 2006 Multilevel Model of Kindergarten Reading

	Basic Model	Teacher–Child Relationship	Child's Experience	Full Model
Intercept	107.21*** (.67)	107.04*** (4.28)	110.60*** (6.93)	171.81*** (11.98)
Teacher–Child relationship		.05 (1.09)	.05 (1.10)	.96 (1.18)
Classroom				
Teacher–Child Classwide Interactions			-.06 (.09)	-.08 (.09)
Classroom Adult–Child Ratio			-.16 (.34)	-.15 (.35)
Child Characteristics				
Gender				.58 (1.33)
Age				-1.15*** (.13)
Child non-Hispanic White				-.37 (2.14)
Child non-Hispanic Black				2.45 (2.60)
Child non-Hispanic Other				1.71 (2.38)
Child Temperament				.20*** (.04)
Identified Special Need				-10.90* (5.12)
Home Language				1.38 (1.83)
Family Income				.51 (.43)
Mother's Education				2.58** (.81)
Random Effects Components				
Identity (cons)	101.81 (11.91)	101.82 (11.91)	101.55 (11.62)	89.46 (8.72)
ID (Residual)	94.37 (7.76)	94.37 (7.76)	94.37 (7.60)	69.60 (7.09)
Log Likelihood	-404366.65	-404366.52	-404366.22	-361286.02

t=p<.10, *=p<.05, **=p<.01, ***=p<.001

Table 33. FACES 2006 Multilevel Model of Kindergarten Math

	Basic Model	Teacher–Child Relationship	Child's Experience	Full Model
Intercept	93.97*** (.73)	90.64*** (5.58)	94.94*** (7.65)	1168.20*** (15.47)
Teacher–Child relationship		.87 (1.46)	.88 (1.46)	1.80 (1.52)
Classroom				
Teacher–Child Classwide Interactions			-.08 (.10)	-.15 (.10)
Classroom Adult–Child Ratio			-.08 (.35)	-0.04 (.42)
Child Characteristics				
Gender				-2.13 (1.75)
Age				-.61** (.18)
Child non-Hispanic White				-1.26 (4.03)
Child non-Hispanic Black				-2.05 (3.58)
Child non-Hispanic Other				-5.88 (4.37)
Child Temperament				.27*** (.04)
Identified Special Need				-8.08* (3.18)
Home Language				-1.71 (1.96)
Family Income				.90t (.51)
Mother's Education				2.86*** (.86)
Random Effects Components				
Identity (cons)	122.73 (16.66)	122.29 (16.70)		118.20 (16.76)
ID (Residual)	122.28 (11.66)	122.19 (11.64)		99.53 (10.96)
Log Likelihood	-418863.81	-418826.26		-380269.30

t=p<.10, *=p<.05, **=p<.01, ***=p<.001

Table 34. FACES 2006 Multilevel Model of Kindergarten Prosocial Behavior

	Basic Model	Teacher–Child Relationship	Child's Experience	Full Model
Intercept	18.28*** (.25)	14.12*** (3.68)	14.12*** (4.02)	-1.78 (7.35)
Teacher–Child relationship		1.10 (.96)	1.10 (.96)	1.13 (1.02)
Classroom				
Teacher–Child Classwide Interactions			-.02 (.03)	.01 (.03)
Classroom Adult–Child Ratio			.16 (.12)	.06 (.15)
Child Characteristics				
Gender				1.82** (.60)
Age				.21** (.08)
Child non-Hispanic White				-2.74*(1.07)
Child non-Hispanic Black				-1.96 (1.66)
Child non-Hispanic Other				-.19 (1.24)
Child Temperament				.02 (.02)
Identified Special Need				-3.34t (1.74)
Home Language				-.72 (1.41)
Family Income				.17 (.27)
Mother's Education				-1.01** (.37)
Random Effects Components				
Identity (cons)	12.03 (1.29)	12.13 (1.28)	11.96 (1.27)	12.26 (1.37)
ID (Residual)	11.75 (1.03)	11.64 (1.01)	11.64 (1.01)	8.92 (1.08)
Log Likelihood	-218697.32	-218307.03	-218305.68	-171161.42

t=p<.10, *=p<.05, **=p<.01, ***=p<.001

Table 35. FACES 2006 Multilevel Model of Kindergarten Problematic Behavior

	Basic Model	Teacher–Child Relationship	Child's Experience	Full Model
Intercept	6.66*** (.38)	15.35*** (4.88)	12.06*** (5.43)	43.19*** (8.98)
Teacher–Child relationship		-2.28t (1.27)	-2.28 (1.27)	-2.33* (1.07)
Classroom				
Teacher–Child Classwide Interactions			.09* (.05)	.05 (.05)
Classroom Adult–Child Ratio			-.14 (.18)	-.05 (.22)
Child Characteristics				
Gender				-2.63** (.86)
Age				-.36*** (.10)
Child non-Hispanic White				3.76* (1.55)
Child non-Hispanic Black				3.48* (1.72)
Child non-Hispanic Other				-1.93 (1.93)
Child Temperament				-.06** (.02)
Identified Special Need				5.34* (2.39)
Home Language				-.17 (1.53)
Family Income				-.34 (.35)
Mother's Education				1.20** (.44)
Random Effects Components				
Identity (cons)	27.58 (2.94)	28.36 (3.04)	27.63 (2.94)	27.46 (3.37)
ID (Residual)	22.53 (2.64)	22.05 (2.49)	22.05 (2.49)	12.75 (1.61)
Log Likelihood	-246890.89	-245996.54	-245994	-183324.99

t=p<.10, *=p<.05, **=p<.01, ***=p<.001